JUL 23 1934

ELECTRICAL WORLD

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JULY 21, 1934

ELECTRICAL MANUFACTURERS SAY BUSINESS IS BETTER

Orders up . . . Future fair . . . Code aid debated

GREAT BRITAIN REPORTS ON THE NEW GRID SYSTEM

Spent $135,000,000 . . . Industry decentralizing . . . Present operations

BEWARE OF AVERAGES IN DISTRIBUTION COST STUDIES

Data show actual costs vary over wide limits

RALPH BUDD TALKS ABOUT NEW STYLE ELECTRIFICATION

The new Zephyr starts radical changes

WATER IS NOT AFFECTED BY ELECTRICAL GROUNDS

Newspaper stories not warranted by the facts

NEW DEVICE USED TO CHECK SYSTEM FAULTS

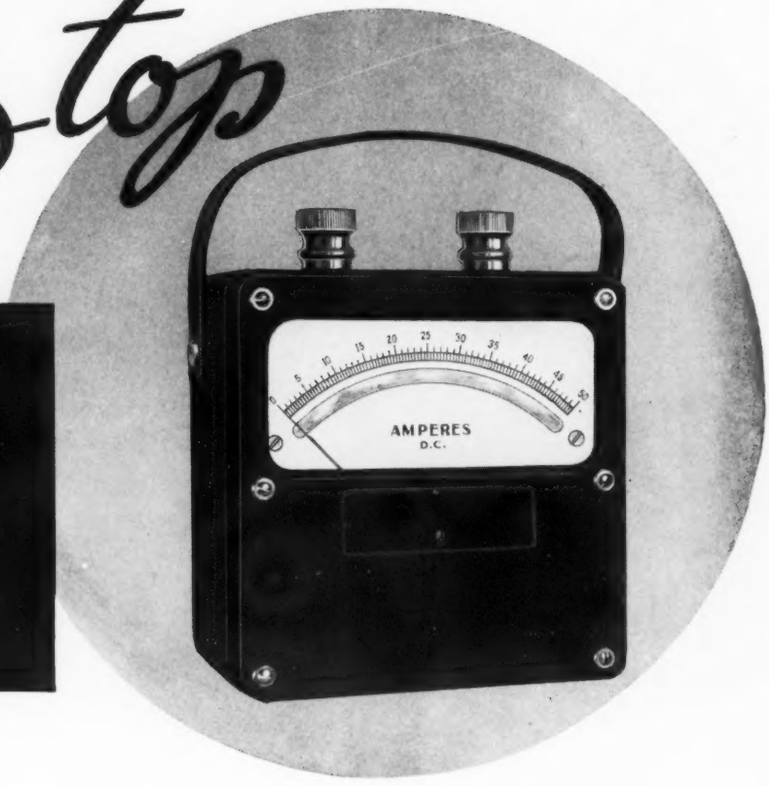
One property uses the oscillograph to advantage

WHAT THE STATISTICS SHOW ABOUT BUSINESS

Industrial barometer . . . Kilowatt-hour barometer

LOCATE and Stop

YOUR WASTED POWER



The accumulation of small, hidden losses from bearing friction, shaft misalignments, improper mesh of gears, tight or loose belts, etc., means an added burden to the cost of production. Likewise, overloaded or underloaded motors add their share of non-productive expense.

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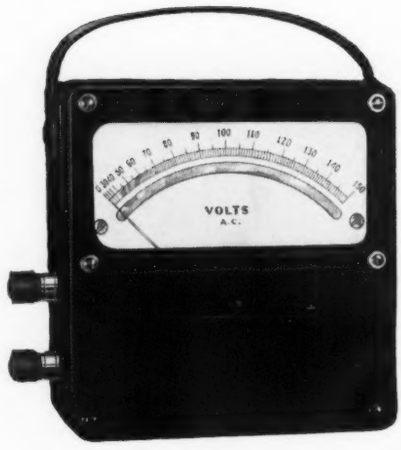

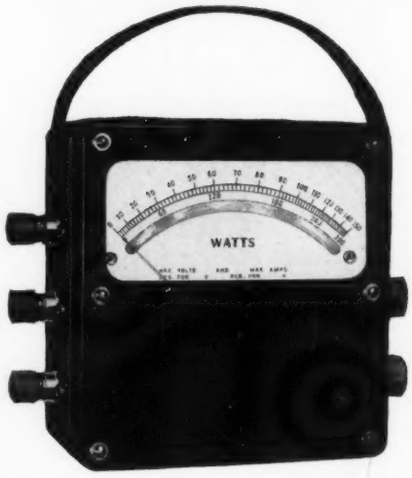

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ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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THIS INDEX is merely a convenient guide. Many articles will appeal to several reader groups—many will apply to all. News and other departments are of general interest.

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ELECTRICAL WORLD

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July 21, 1934

L. W. W. MORROW, *Editor*

We Venture to Predict Good Business

Business is largely measured in terms of faith and confidence. This is very evident at present in the electrical industry. Both utility and manufacturing executives now lack confidence. Too often conclusions are not based upon facts available. There is a bad psychology existing that is a natural human reaction, but which is detrimental to industry welfare. It is contrary to the past reputation of the electrical industry whereby it took chances and always went ahead.

What are the facts and what are the prospects? Utility energy sales are at the 1929 level for domestic, about 3 per cent below this level for wholesale and 2 per cent below 1929 on total sales. Measured by the latest energy consumption figures in factories, we find steel, metal-working and automotive plants above the 1923-25 average. Chemical plants are 20 per cent above the 1929 level, rubber at the 1929 value, stone, clay and glass 15 per cent below 1929, or at the 1923-25 level, and consumer goods factories, such as leather, textiles and food, at 1929 levels. These facts show a volume of business activity that would be very encouraging in normal times.

And prospects for the summer and fall are good. The government is spending and will continue to spend—remember the fall elections are coming. Relief funds and funds from the alphabetical organizations are and will continue to pour into the hands of purchasers. Congress has adjourned. Another month or two of figures on orders and billings similar to those shown in the article in this issue will create confidence in electrical manufacturing executives and change their psychology. Utility executives will gain confidence from present sales and sales programs. There is every reason for the electrical industry to bank upon a steadily increasing volume of business for the next six months. How much this increase will be, however, lies largely in the attitude with which the industry executives look upon present business prospects. We believe their present attitude is too pessimistic in view of the facts available and the prospects in store for the coming months. This attitude is not typical of electrical business men and results from the abnormal but superficial washings and sweepings in Washington. It is un-American.

More About Distribution Costs

One way of getting at distribution costs by a royal route would be (1) to make the cities exact topographical and geographical replicas of one another, (2) make the organization structure of all electric utilities identical and, finally, (3) write an acceptable electrical dictionary of every term—technical and commercial—that applies to the business. Lacking those Utopian objectives, some of the differences found in distribution costs are bound to exist. Unless these differentiating factors are recognized, all the struggle to straitjacket distribution costs into a single simple formula will continue to resemble the frantic futility of a fresh lion in an old and tested cage. Certainly any attempt to use averages will be like trying to define the characteristics of an average lion.

Elsewhere in this issue Colonel Lacombe makes an approach that jibes distribution costs with the accepted method of charging for the service. The Hopkinson principle has largely determined accounting classifications and can likewise logically be used to compare costs with prices, which is one, if not very legitimate, object in making distribution studies.

Even when this has been done there is still the spread that is bound to arise because of differences in customer density, in proportion of overhead to underground, in practices as to merchandising and promotional activity, and so on.

The conclusion is that averages are wholly unsafe and unfair to use as a persuasive yardstick and, also, the rates to attach the most appropriate volume of business will still have to be flavored with sound competitive business judgment, whether the distribution cost study shows a relatively high or low figure by these methods. Their greatest virtue lies in indicating who has been profligate in assuring good service, who has been penurious, who has favorable local conditions and who has the unfavorable. The greatest merit in distribution cost studies at present is to show engineers their past mistakes so that they may not be repeated in the future.

Make It Plain to the People

Not long ago the Commonwealth & Southern company elected as directors the presidents of its several operating subsidiaries. They replaced as many bankers or men not immediately concerned with that organization. Now bankers are not popular in America and holding companies are under question. This change was therefore in tune with present thinking and was recognized as such, even though little was said of the reasons and the results expected. There was an excellent opportunity for a plain statement of policy that would have been of broad interest and benefit. It was not capitalized, but in spite of that the news sounded good.

And then shortly after came the similar announcement of a change in the board of the United Corporation. There the operating men were replaced by bankers and the inference was drawn in the press reports that this company was apparently preparing to become more of an investment trust and less a public utility organization. If not, it sounded reactionary and out of step. People asked, "what does it mean?"—because in the news the reasons were left in mystery.

Now nobody doubts that both these changes were the expression of well-laid purposes and plans. But these holding companies own many operating utility companies that belong to many people. There is a direct public interest in all that these two corporations do. Every reader of the newspaper, therefore, feels that he has a right to know. And there is a general reaction of suspicion or resentment whenever anything is done in the affairs of such organizations that seems to be against the general expectation and desire. Since this is so, then why not make plain why every step is taken, why each move is made? Sound reasoning is soon recognized. Good planning wins quick approval. Wise management reflects itself when it is not masked by secrecy. There is no reason for withholding the facts one-half as potent as the reasons why management today should be entirely frank. It is so easy to let the public understand, so hard to correct a false impression once it starts.

Drinking Water Not Spoiled by Protective Grounding

Following years of experience with grounding a.c. power systems on buried water pipes, any fears that the practice would injure the pipes or the water ought to be completely dissipated. Recently, however, there occurred in one area a revival of such misgivings because of isolated instances of complaints about the quality of the water, for which no other cause was apparent. But facts which should set these completely at rest were cited by H. S. Warren, director of protection development, Bell Telephone Laboratories, Inc., in a discussion of protective grounding on water pipes before a recent meeting of the New England Water Works Association.

Tests have shown no corrosion whatever occurs where the current remains wholly in the pipe. Somewhat more elusive is the suspicion that the slight current which may flow in a pipe as a result of protective grounding may in some manner affect the quality of the water. Mr. Warren did not presume to predict the results of pending investigations on this point, but he did give ample reason for believing that grounding in accordance with the National Electrical Code, which provides that there shall be no objectionable passage of current over the grounding conductors, does not affect the water.

We believe with Mr. Warren that code grounding should have the full confidence of water works people and that nothing will be uncovered to show that water gets a flat taste because trivial grounding currents flow in the pipes. But let such tests as may be in progress continue so that their wholly negative results will clinch the argument once and for all. If, by the remotest chance, it should be discovered that protective grounding has any deleterious effect on pipes or water, and that this effect could be avoided by some economically feasible scheme, the electrical industries will be found ready to listen and negotiate anew.

Railroad Electrification— New Style

An interview with Ralph Budd, president of the Burlington Lines, whose new "Zephyr" train, with others of its kind, is now making railroad history, and in doing so is forcing a revision of the popular conception of what is included in railroad electrification.

ALMOST from the beginning of the electrical industry electricity as the motive power for transportation has been both an accomplishment and a dream. It has been an accomplishment by many years of successful application to the mass transportation of passengers in cities. In spite of automobile and bus competition, the street cars still remain the most effective means for carrying the urban citizen from home in the morning and from work at night. It has been a dream in that electricity has not yet displaced steam to any large extent for long-distance transportation. Railroad electrification on the grand scale is still a dream. And, from the indications of present rapid development, it is a dream that probably never will be realized in the form that most people, including many engineers, conceive it.

The popular picture conjured up by the word "railroad electrification" is one of immense generating stations, transmission lines and substations supplying power through trolleys or third rails to trains speeding across the nation. Often included in this picture is the utilization of our "vast resources of water power" supplying the greater part of the energy thus required. Although this concept of railroad electrification has had some outstanding realizations, both in this country and abroad, and one very large one (on the Pennsylvania Railroad) has just recently gone into operation, it probably can be said that in the sense of universal application railroad electrification in the classic style is a beautiful idea that once was supposed popularly to have a promising future, but now that future seems more remote.

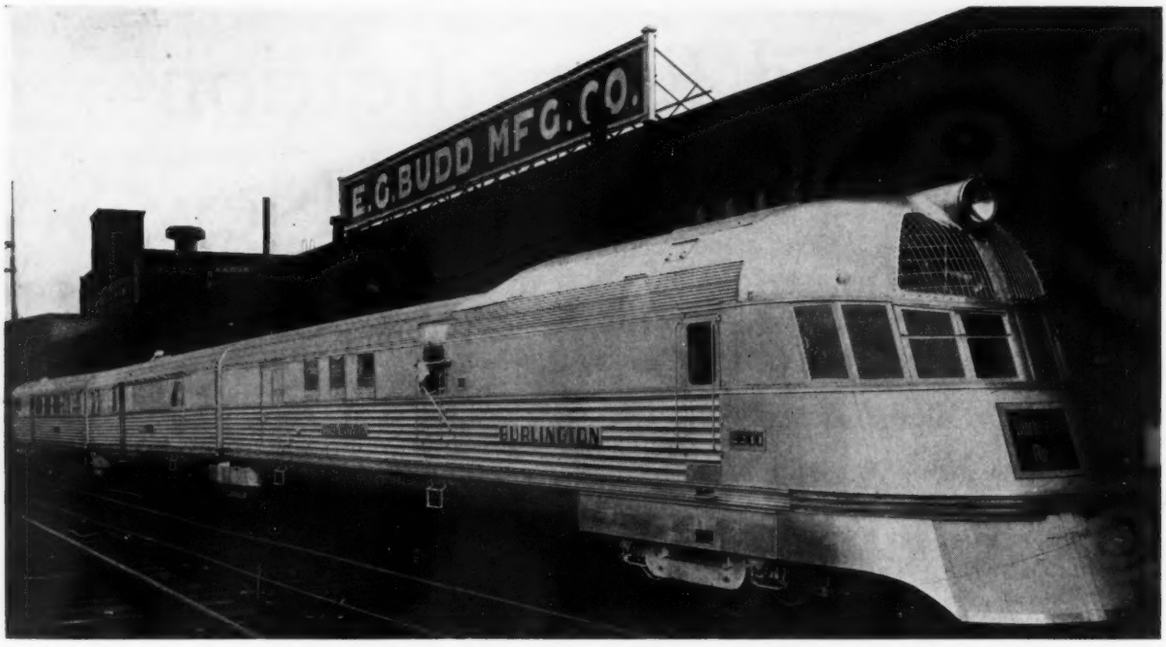
Those people—engineers, business men, politicians or just plain citizens—who see in their minds' eyes all railroad trains all over the country operating from water power or any other central-station energy supply are, it seems to me, neglecting the plain significance of recent events. As a matter of fact, the idea of justifying large expenditures of money for water-power development on a national scale on the premise that the energy so produced can be used economically as railroad motive power has always been entirely fallacious. Even in comparison with steam locomotives, and without taking more recent things into consideration, the cost of railroad electrification outside of dense traffic and other special areas would be so great that the idea could not be carried out even if it promised power to the railroads at no cost at all. The present trend in railroading toward lighter weight, stream-lined, self-powered trains is just additional weight in the balance against railroad electrification as it is shouted by political spellbinders, dreamed by idealists and seemingly accepted by the people at large.

This is not to say that electrification, including power supply from central generating stations, is always inadvisable. Such a statement would be far from the truth. Contact electrification still holds those special fields in which it has been economically justified in the past and of which it will probably remain in possession. One of these fields is service in extraordinarily heavy traffic areas where the volume of business is sufficient to pay the cost. The Pennsylvania electrification earlier referred to is a good example of this. Another field for contact electrification that will probably remain is service in mountain divisions, where the cost of double tracking to provide increased transportation capacity may be inordinately high. Also in mountainous country contact electrification may be justified for long tunnels in considerations of safety and passenger comfort. Smoke abatement requirements in and around large cities indicate the remaining field for electrification by contact means.

Electric power the best

Electric power to drive trains is the modern meaning of railroad electrification. In this meaning informed thought leaves no room for large inclusion of power supply from central stations. Power will come generally from prime movers on the trains themselves. What those prime movers will be is a matter to be settled between the internal combustion and the steam engine. But it certainly appears that country-wide electrical systems have no place in the future of railroad electrification.

Is it necessary for me to present evidence of this radical change in the future picture of railroad electrification? One has only to read the newspapers to see the evidence. Our own "Zephyr" and the later trains to follow it, the Union Pacific stream-lined train, the two



The new style in railroad electrification

ordered by the Baltimore & Ohio, the New Haven, the Boston & Maine trains, as well as many single-car and light-weight unit developments of which one continually hears, all of these add up to an impressive indication not only of new thinking in railroading itself but of new ideas in the application of electricity to it.

By the virtue and achievements of metallurgical research we now have something new in power plants and in the trains they drive. Chromium and other alloys of steel applied to Diesel engines have given us a power plant in the "Zephyr" that weighs only 21 lb. per horsepower, a weight less than a third of previously conceived Diesel power plants. By the lightening of both train and power plant the power required is brought well within the capacity of the Diesel engine.

Thus we can think of railroad electrification as a matter of mounting the power plant on the train itself instead of the generating station being possibly a hundred or more miles away. Bringing the power plant and traction motors close together in this way eliminates energy transmission and transformations, removes the need for trolley or third rail contacts and allows the primary generation of low-voltage direct current which presents simple problems of control and the power is applied to a type of motor ideal for traction purposes.

Railroad electrification, old style, required that the whole job for any system or operating unit be done at one time. It required, also, a tremendous initial investment that could seldom be contemplated in existing conditions of railroad operation and revenue. Railroad electrification, new style, requires no staggering first investment; it can be done piecemeal, in a gradual and undisturbing substitution of new for old facilities.

From the electric utility point of view this radical change in the aspect of railroad electrification means the loss of a huge potential market. But that market always was more nebulous than real. Such of it as did hold actual promise still largely remains in the three fields of contact electrification previously discussed. Thus there is no reason for repining among the power companies at the new direction of development in railroad electrification. As for the electrical manufacturer, it should be apparent that this development may very well mean a larger market for his product, certainly the market for electrical goods in railroad electrification under the new dispensation will be steadier and capable of more immediate working. It is true that less equipment of certain obvious types will be required, and it is true also that more of other types will be needed. Each train or locomotive will be a power plant in itself, and this will mean the sale of many thousands of generators, motors and control devices.

The new developments in light-weight trains promise electrification to light traffic lines. The character of line, thought by practical railroad men to be farthest removed from the possibility of electrification, is now brought right into it. We have been thinking of electrification as something to spread outward from heavy to light traffic areas. The conception is now reversed. Or we should say that the new thing in electrification promises to spread inward from light to heavy traffic. How far it will go before it stops is a question to which no answer can be given now. But it certainly appears to be the case that railroad electrification, new style, has effectively circumscribed the idea of electrification as it is usually thought of.

I should not end this discussion without mention of the power source—steam—which has served the railroads so long and so well and which is not by any means meekly letting itself be crowded out of the picture. The steam locomotive manufacturers are not leaving the field of development of high-speed, light-weight trains to the internal combustion engine. One of the Baltimore & Ohio trains now on order is to be steam powered. But it can be said with certainty that the progress that comes from the rivalry between the two types of prime movers will be additional argument against railroad electrification, old style.

What About Business?

Are Conditions Sound?
Has the Code Helped?
Is Competition Fair?
What of the Remainder of the Year?

By L. W. W. MORROW
Editor *Electrical World*

ELECTRICAL manufacturers have been asked to give opinions and data on present business conditions. Many leading electrical manufacturers, chiefly makers of durable goods, replied to a questionnaire sent them, and a summary of the replies gives a fair cross-section of current business in this branch of the electrical industry. The questions asked are given and the summary of replies:

1. What is your opinion of the general business situation at this time?

Seventeen consider this unsettled and uncertain, seven consider it discouraging and twelve consider it quite encouraging. The reasons given for the opinion that the situation is very uncertain is fear of the future, the threat of further legislation and the threatening labor conditions. Those who consider it discouraging state that business is being done largely by government spending only and they see no stable basis for commitments by private business. Those who find business encouraging largely look at their increased sales and cite the stabilizing influence of the codes. In general, the reply to this question reduces to the psychological reactions of each executive to the changes that have occurred in the past year. A vast majority of electrical manufacturers consider present conditions temporary and are quite uncertain about the future.

2. What do your customers think about general business conditions at this time?

Eighteen replied that customers were unsettled and lacked confidence in present business, seven stated their customers were very pessimistic about business and eleven stated that the opinion of their customers was quite encouraging about the soundness of present business. Here again the majority reply was based upon lack of confidence in the future, fear of legislation and differences of opinion as to the effect of recent administrative measures. Lack of confidence in the future appears to be the greatest single handicap to a better customer psychology.

3. What do you think business prospects look like for the remainder of the year as compared to your business in the first four months?

Eighteen look for increased business, eight believe business will hold level and ten believe it will decrease. Some estimate a business increase of 30 per cent over the first four months of the year and others a business decrease of 30 per cent even though dealing with the same classes of products. All report a very large gain in orders and in billings for the first four months of this year as compared with the same period last year. An estimated average is that electrical manufacturing business increased 100 per cent for this comparable period.

4. Are price levels satisfactory?

Twenty-one consider price levels satisfactory, eleven consider prices too low and three consider prices too high. It is interesting to note that the three who consider prices too high state that prices prevent business volume and carry inefficient competitors. Those who consider prices too low state the volume of business is too small to enable them to make profits at current prices. Considering the present volume of business the conclusion may be reached that price levels are fairly satisfactory to the manufacturers and an increased business would put them on a very profitable basis of operations.

5. Is competition slow or keen?

Twenty-two say that competition is very keen, nine say it is normal and four say it is slow. In general, because of the small volume of business, competition is very keen, but there still prevails a practice of giving business to those manufacturers who have served the customers in the past. Government business which is allocated upon the basis of the lowest bidder affords opportunity for the keenest competition at this time.

6. Is the volume of business too small?

As was to be expected, twenty-nine said the volume was too small, but five said there was a fair volume. Business is largely in the form of job-lot orders for immediate necessities except for that had from the government. The total volume is far below the available productive capacity except in the case of some appliances.

7. Are buying habits unfair?

Ten say that buying habits are unfair and several cite the utilities and the government, but twenty-three say buying habits are very fair.

8. Has the code aided or injured your business?

Eighteen say the code has had no effect whatever on their business, eight say the code has aided them to do

Table I—Increase in 1934 as Compared to 1933
(Four-Month Period)

Manufacturer Number	Orders, per Cent	Billings, per Cent	Manufacturer Number	Orders, per Cent	Billings, per Cent	Manufacturer Number	Orders, per Cent	Billings, per Cent
1.	60	30	12.	225	330	23.	30	25
2.	115	100	13.	60	60	24.	190	153
3.	100	90	14.	50	22	25.	130	150
4.	69	43	15.	100	70	26.	21	21
5.	82	89	16.	100	100	27.	140	118
6.	300	220	17.	85	80	28.	51	52
7.	80	40	18.	15	15	29.	96	96
8.	150	300	19.	82	80	30.	50	46
9.	200	200	20.	134	117	31.	80	105
10.	110	100	21.	42	28	32.	48	15
11.	500	450	22.	150	150			

Table II—Opinions About Business

(Each figure represents number of manufacturers)

1. Opinion of general business situation.
   Encouraging 12. Discouraging 7. Unsettled 17.
2. Customer opinions of general business situation.
   Encouraging 9. Discouraging 8. Unsettled 18.
3. Your business prospects for remainder of year.
   Up 18. Down 10. Level 8.
4. Will price levels increase or decrease?
   Increase 15. Hold level 18. Decrease 1.
5. Are price levels high, low or fair?
   High 3. Low 11. Fair 21.
6. Is Competition slow, keen or fair?
   Slow 4. Keen 22. Fair 9.
7. How is the volume of business?
   Low 29. Fair 5.
8. Are buying habits fair or unfair?
   Unfair 10. Fair 23.
9. Has the code aided or injured your business?
   Aided 8. Injured 9. No effect 18.

business and nine say the code has injured their business. This cross-section shows, in general, no appreciable evidence of either aid or injury from the code based upon facts, but it shows also that very positive but different opinions exist as to the value of the code. The code is not yet sold well to electrical manufacturers.

9. Do you expect price levels to increase?

Fifteen believe prices will increase at least in the order of 10 per cent. Eighteen believe that prices will hold at present levels unless there is a marked increase in labor and material prices. Only one believes prices will decrease.

10. Are you adding new lines or promoting new markets?

Many manufacturers are undergoing reorganization to improve sales and products. Most of them are following changed marketing conditions closely and are changing product designs to fit buying needs to better advantage. No very revolutionary steps or suggestions were brought out in these replies.

11. What markets are active?

The government takes first place in most replies, with steel, textile, coal, food, chemicals and automotive as other leaders. Utilities are buying chiefly for distribution, for maintenance and for merchandise and appliance sales. New construction is largely confined to government work only.

Conclusions

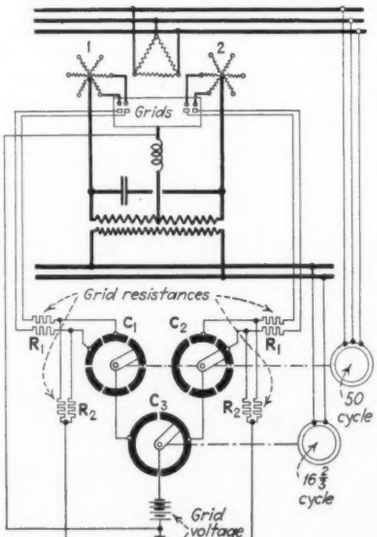
One is struck by the psychology of uncertainty that prevails. Despite increased orders and billings, there is a general feeling of uncertainty about the future that is handicapping business development. Legislation such as the securities act, the labor bills and the tax bills, the undecided influence of the codes, the discussion of social and monetary policies in Washington and the effect of the many recent and rapid changes have influenced manufacturers more than the positive increase in business recorded on their books. They are selling and spending on a day-to-day basis because of fear of the future, even though this fear is not founded on fact or reason. It is a human reaction to rapid changes and an unsettled economic and social structure.

For the remainder of the year there is no doubt of a stable business volume at present or greater levels because the governmental expenditures alone will sustain this condition, but the full value of present business possibilities will not be realized until electrical manufacturers make some commitments based upon confidence in the future. Continued orders and the adjournment of Congress promise to give this confidence to this branch of the industry.

Static Converter Couples Traction, Power System

Swiss development uses grid-controlled rectifier as valve and inverter to give flexible frequency coupling between 16⅔-cycle railway and 50-cycle general power system without rotary power converting equipment.

Unified supply of power for traction and general purposes has generally been met by using synchronous frequency changers to link the 25-cycle system of one with the 60-cycle system of the other. A new development of rectifiers in Europe shows the way to accomplish this purpose with static equipment involving grid-controlled rectifiers. There the common use of 50 cycles for general distribution and the resort to 16⅔ cycles for railway electrification makes easy the employment of the new scheme,



Flexible static converter couples 16⅔- and 50-cycle systems with distortionless power interchange

which hinges upon the harmonic principle. As evolved and reported in the Brown, Boveri *Review* for June, 1934, it meets the requirements that an adjustable amount of energy shall be exchanged in either direction between the two systems, independently of any variation in the frequency ratio. It does this at good efficiency and with minimum distortion of the voltage wave of either system.

The inherent difficulty in perfection of static schemes for frequency conversion and for single-phase draft from a polyphase system has been the need for means of storing the single-phase energy pulsations. In rotating equipment the mass inertias perform this function. This new scheme of Brown, Boveri & Company is based on a combination of choke coils and condensers for storing energy; the condenser elements are further relied upon to supply the wattless power to the single-phase network.

Inserted in the lead from the valve to the center tap at

the primary of the single-phase output transformer is a "voltage smoother" or choke which stores part of the energy. Its purpose is to take up the difference between the sinusoidal single-phase voltage required and the rectangular voltage wave form from the valve. Across the outer single-phase leads from the neutral points of the two diametrical valve transformers is the condenser, which serves as (1) a "current smoother" and (2) as a source of reactive kva. for the secondary load. It takes up the difference between the rectangular current of the valve and the sinusoidal. With proper modification of these rudimentary correctives the resultant output power wave can not only be rendered sinusoidally pulsating but also converted to one-third the input frequency. Any surplus wattless capacity of the current smoother can be applied to improve the power factor of the three-phase network.

Actually the voltage smoother must consist of a mesh which will eliminate only the even numbered harmonics and the current smoother must permit only the even numbered harmonics. Thus at the terminals of the current smoother there must be a voltage composed of the same harmonics as the current of the current smoother. No synchronizing whatever is necessary when starting. As seen from the accompanying control diagram the synchronous commutators of both frequencies vary the duration of brush contacts in such manner as to permit the apparatus to function independently of the ratio of the two frequencies. In either direction of power flow or conversion the valve loads one network as a rectifier and supplies power to the other network as an inverter.

The advantages claimed by Ch. Ehrensperger for the new static converter are: Symmetrical loading of three-phase network, high efficiency, sinusoidal single-phase voltage, perfect flexibility, direct conversion in a single stage, simple starting, elimination of all synchronizing equipment, good three-phase power factor, advantageous utilization of the valve and automatic power regulation. Tests on a 200-kw. experimental unit have confirmed these characteristics.

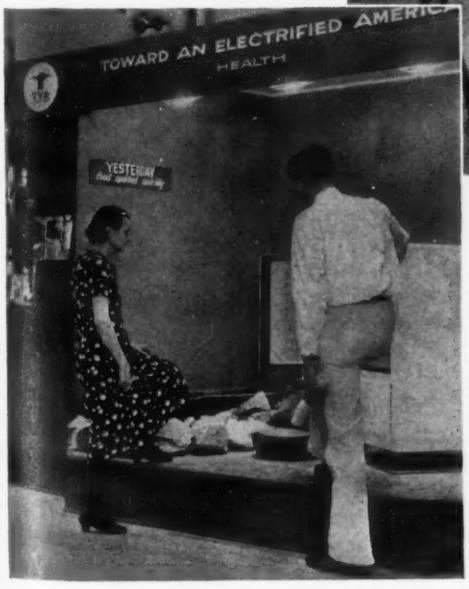
Tupelo Capitalizes the Primitive

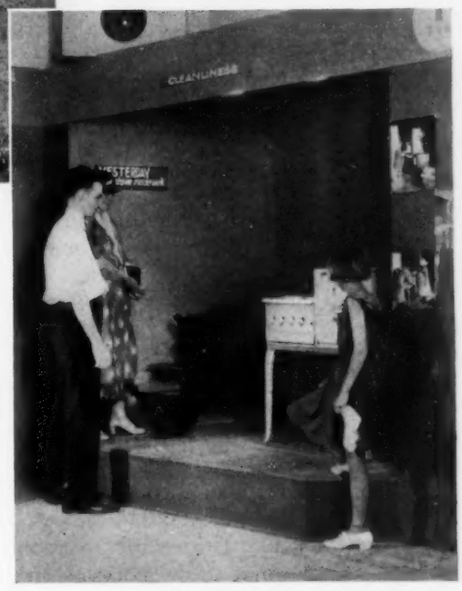
Dramatic contrasts with the primitive methods of housework still extensively in use in the Tennessee Valley region are being featured by the Electric Home and Farm Authority. In Tupelo, Miss., the first active campaign of appliance demonstration indicated that the promotional methods which this government agency projected are beginning to shape themselves.

Tupelo has a population of 6,350, including colored. During the first week of the E.H.F.A. appliance show 7,289 persons visited the exhibition, obviously including a large number of people from the surrounding country. Here the "cooling well" and the old time "watering trough cooler" are still extensively in use for keeping foods. And much of the cooking is still done in cast-iron pots on small black iron stoves burning wood or soft coal. Therefore, these ancient, laborious and unsatisfactory devices are made the central feature of the Tupelo display, as shown in the accompanying illustrations.

From May 21 to June 22 local merchants have reported the sale of 188 refrigerators, 43 ranges and 13 water heaters. Although special low-priced T.V.A. "emblem appliances" are offered 123 of the refrigerators sold, 12 ranges and one water heater were standard models at high prices, selected by the purchaser for the additional features of convenience and comfort they provide.

A typical "cooling well" still extensively used in the Tennessee Valley country





Against this primitive background electrical refrigeration is being demonstrated by the Electric Home and Farm Authority in its exhibit in Tupelo. Other booths contrasted the water trough cooler and the soft coal kitchen stove.

Beware of "Averages" in Distribution Cost Studies

Some Valid Standards of Comparison Essential to Any Real Study of Energy Distributing Costs

By
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Lacombe & Leffler, Engineers, New York

IN THE past year more than usual interest in the distribution investment and operating costs of electric utilities has arisen. This was accentuated by the meeting of the Institute of Public Engineering on January 20, 1933, which generally discussed the subject of distribution. The problem to which most attention was devoted was the cost of distributing electricity to the residential class of customers.

Both before and since the meeting of this institute several other valuable contributions have been made to the subject, and some were referred to by the institute. The main article on cost of residential distribution in the proceedings was a paper by Clayton W. Pike, consulting Engineer of Philadelphia, on "Distribution Cost of Electric Energy, With Special Reference to Residence and Rural Customers." Criticism of this article by Constantine Bary of Philadelphia and a reply by Mr. Pike were published in the ELECTRICAL WORLD of August 19, 1933, and January 27, 1934. An article on the subject "Average Cost of Distributing Power," by Hudson W. Reed of Philadelphia, was published in the *Public Utilities Fortnightly* of October 26, 1933, and November 9, 1933. Also an article on "Economics of the Power Industry," by Col. William Kelly, March 16, 1931, published by the National Electric Light Association. These papers, with those of the institute proceedings as published by Mr. Cooke, seem to set forth the figures and opinions of both the public authority side and the public utility side.

Taking the institute's idea of what constitutes both distribution investment and operating costs as defined in Mr. Pike's article and setting up these costs of distribution in parallel columns, differences are found between each analysis and any other. Distribution costs were defined as those between the outgoing distribution wires at the substation and the customer's meter, inclusive.

These differences are not unexplainable, however, if one considers known conditions. It is generally admitted that the distribution underground and overhead lines of various companies are rarely, if ever, identical, and on account of varying conditions of density of customers, the distribution system adopted and the physical terrain governing its construction, the distribution systems of lines only vary materially both as to investment and operation. It is also known that the utilization, commercial, new-business and general and miscellaneous expenses vary to a marked degree, depending on different administrative and selling policies adopted in different situations. So, in order to show how close comparison may be made, one may separate the more stable costs from the variable costs depending on the differing policies of business expansion. Further, Mr. Pike warns one against the careless use of averages, and as a matter of fact in an analysis to get the actual costs of any distribution system it is found that *averages are of as much value as the mere knowledge of the average size of the men is valuable in ordering the uniforms for a regiment of soldiers.*

Use of a standard for comparison

It is necessary to have a standard of comparison by which to set up parallel comparative columns, and to obtain this there has been taken the uniform classification of accounts and a form of analysis is applied to them based on the Hopkinson theory of the elements of demand (kw.), energy (kw.-hr.) and customer costs. In the tables given, with slight variation, all but Mr. Pike's costs have been obtained by an application of this method. By contributing three analyses made by the writer, one can give seven examples of distribution costs, both investment and operating, and it adds to their weight to say that six of the analyses were made by four separate analysts working on the same general Hopkinson theory; in other words, using the same process of analysis for comparison.

Investment comparisons

Table I gives the unit investment costs of the entire distribution system per customer as defined by the institute for each example, except two, where it was not available, and below this unit system cost is given the investment costs per customer of the residential or domestic part of the distribution system. No street-lighting investment or working capital is included.

The original investment costs of the distribution systems were obtained from the uniform classification of accounts by the Hopkinson method of demand analysis, just mentioned, and the unit costs shown here were derived from such results by dividing them by the number of customers. This analytical method precludes any so-called mystery of derivation of distribution costs.

Properly, several of these items should be divided by the kilowatts of demand used, not customers, but as this could not be done in two cases and as one method of comparison must be used for convenience, the number of customers is taken for the unit divisor for ease of comparison only.

Very broadly, the physical characteristics of the cities affecting the distribution systems analyzed are as follows:

Company No. 1—A manufacturing city radiating from a well-defined business center. Residences in area surrounding business center.

Company No. 2—A manufacturing city, very much larger than Company No. 1 and radiating out from a river in a half circle, with the residential quarters beyond the business center. This company also serves many suburban towns adjacent to the main city.

Company No. 3—Covers almost an entire state, serving several cities and towns of fair size with many small villages and settlements.

Company No. 4—Serves a number of small cities, villages and communities in a manufacturing and mining area, spread along like beads on a net.

This study of the cost of distribution, now a topic of such importance to the industry, presents actual data. It demonstrates the absurdity of using average values in measuring the comparative performance of properties. This study should go far to remove some of the existing misconceptions.

Mr. Reed's example is that of a company operating under normal conditions, somewhat resembling Company No. 2. Colonel Kelly's example is based on data from several localities, again reflecting normal conditions. Other important characteristics are that in Companies No. 1 and No. 2 a considerable part of the distribution system was underground and it is impossible to separate the underground distribution costs from the overhead costs, so the unit distribution investment in these two cities is the combined underground and overhead lines demand cost divided by the number of customers. Strange as it may appear, the distribution lines investment per customer in a mixed underground and overhead system is less than where only overhead construction is used. Companies No. 3 and No. 4 use overhead construction only.

Mr. Reed's example is for overhead costs only, as the

Table I—Unit Distribution Investment Cost—All Customers, per Customer Basis

	Company No 1		Company No. 2		Company No. 3		Company No. 4		Mr. Reed's Example		Col. Kelly's Example	Mr. Pike's Estimate
Total No. company customers	69,211		558,853		115,956		166,571		4,614			
Unit over-all distribution from investment	Unit Cost	% Total Co. Invest.	Unit Cost	% Total Co. Invest.	Unit Cost	% Total Co. Invest.	Unit Cost	% Total Co. Invest.	Unit Cost	% Total Co. Invest.	Not available	Not available
Substation to customer's meter	$99	25.68	$90	31.00	$133	29.96	$125	19.55	$83	30.28		
Except General miscellaneous investment 80 per cent of latter to distribution	21	5.53	34	8.37	12	2.75	19	2.95	17	6.33		
No street lighting	120	31.21	124	39.37	145	32.71	144	22.50	100	36.61		
Residential data, per customer												
Kw.-hr. per customer year	757		643.5		700		658		560		400	550
Aver. No. customers in year	56,202		474,399		93,761		138,207		4,608		200 per mile	.....
Unit over-all residential distribution investment	Unit Cost	% Total Co. Resid. Invest.	Unit Cost	% Total Co. Resid. Invest.	Unit Cost	% Total Co. Resid. Invest.	Unit Cost	% Total Co. Resid. Invest.	Unit Cost	% Total Co. Resid. Invest.	Unit Cost	% Total Co. Resid. Invest.
	$50.91	36.43	$47.36	41.39	$62.75	39.96	$76.83	45.47	$71.56	49.85	$39.74	.....
Except General miscellaneous investment	13.71	9.98	12.00	10.48	10.47	6.69	10.29	7.61	12.09	8.42	+11.00 2.69	.....
Total	64.62	46.41	59.36	51.87	73.22	46.65	87.13	53.08	83.65	58.27	42.43 or $53.43	.....
Elements of residential distribution investment	Unit Cost	Unit Cost	Unit Cost	Unit Cost	Unit Cost	Unit Cost	Unit Cost
Land and structures	$1.20	.....	.....	$3.01	.....	.....	.....
Underground conduits	9.95	$21.32	.....	.....	.....	.....	.....
Conductors	7.71		.....	.....	.....	.....	.....
Poles and wires	5.85		$33.16	36.72	$32.27	$13.00	$30.00
Subtotal	24.71	21.32	$33.16	39.73	32.27	13.00 or 24.00	30.00
Services	6.48	6.89	6.95	11.54	13.00	8.50	4.50
Line transformers	7.39	8.33	7.61	8.98	6.29	8.37	6.50
Meters	8.89	10.24	11.25	14.98	18.00	9.87	10.50
Subtotal	47.47	46.78	58.97	75.23	69.56	39.74 or 50.74	51.50
Utilization	2.24	.58	2.91	0.40	2.00	.....	.....
Construction materials on hand	1.20	.....	0.87	1.21	.....	.....	.....
Subtotal	50.91	47.36	62.75	76.84	71.56	39.74 or 50.74	.....
General and miscellaneous investment	13.71	12.00	10.47	10.29	12.09	2.69	3.50
Total residential distribution investment	$64.62	$59.36	$73.22	$87.13	$83.65	$42.43 or $53.43	$55.00

Table II—Unit Distribution Operating Expenses per Customer, per Kilowatt-Hour

	Company No. 1		Company No. 2		Company No. 3		Company No. 4		Mr. Reed's Example		Col. Kelly's Example		Mr. Pike's Estimate	
Number of customers	69,211		558,583		115,956		166,571		4,614		Not available		Not available	
No. kw.-hr. sold	256,869,100		2,287,936,500		409,450,453		1,197,485,213		14,231,280					
	Cust.	Kw.-hr.	Cust.	Kw.-hr.	Cust.	Kw.-hr.	Cust.	Kw.-hr.	Cust.	Kw.-hr.				
	$	¢	$	¢	$	¢	$	¢	$	¢				
Distribution lines expenses only, no street lighting	2.36	0.063	....	.....	1.86	0.074	3.92	0.054	0.95	0.03				
Transformer expenses	0.30	.....	2.41	0.058	0.15	.....	0.39	.....	0.12	.....				
Service expenses	0.044	.....	1.65	0.040	0.17	0.029	0.26	0.25	0.25	0.038	Not available		Not available	
Meter expenses	0.98	0.035	....	.....	0.71	.....	1.17	.....	0.81	.....				
Subtotal	3.684	0.098	4.06	0.098	2.89	0.103	5.74	0.079	2.13	0.068	....	....	....	.....
Utilization	1.06	0.028	1.30	0.031	0.70	0.02	0.31	0.004	0.84	0.027	....	....	....	.....
Commercial	3.26	0.088	4.28	0.104	2.38	0.067	4.29	0.06	3.18	0.103	....	....	....	.....
New business	1.05	0.028	0.79	0.019	2.49	0.07	2.94	0.04	2.37	0.077	....	....	....	.....
Subtotal	9.05	0.242	10.43	0.252	8.46	0.260	13.28	0.183	8.52	0.275	....	....	....	.....
Gen'l and miscellaneous exp.	7.12	0.19	4.77	0.114	5.25	0.149	5.05	0.070	2.96	0.096	....	....	....	....
Total	16.17	0.432	15.20	0.366	13.71	0.409	18.33	0.253	11.48	0.371	....	....	....	.....
No. residential customers	56,202		474,399		93,761		138,207		4,608		200 per mile ave.			
No. kw.-hr. sold	42,538,548		305,349,900		65,509,122		90,942,206		2,580,480		80,000		550	
No. kw.-hr. sold per customer	757		643.5		700		658		560		400		550	
	Cust.	Kw.-hr.	Cust.	Kw.-hr.	Cust.	Kw.-hr.	Cust.	Kw.-hr.	Cust.	Kw.-hr.	Cust.	Kw.-hr.	Cust.	Kw.-hr.
	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢
Residential dist. lines operating expense	0.84	0.103	0.93	0.146	0.83	0.119	2.51	0.381	0.76	0.136	1.17	0.292	....	.....
Transformer expenses	0.18	0.139	1.25	0.195	0.12	0.125	0.19	0.191	0.12	0.185	0.75	0.019	2.00	0.363
Service expenses	0.03				0.13		0.22		0.26					
Meter expenses	0.83				0.61		0.84		0.77					
Subtotal	1.88	0.242	2.18	0.341	1.69	0.244	3.76	0.572	1.91	0.321	1.92	0.311	2.00	0.363
Utilization	1.07	0.134	1.30	0.202	0.70	0.101	0.31	0.047	0.75	0.135	1.57	0.39	0.50	0.09
Commercial	2.91	0.384	3.79	0.589	2.31	0.325	4.11	0.624	3.12	0.558	1.87	0.47	1.80	0.32
New business	0.77	0.102	0.24	0.038	2.50	0.358	2.54	0.386	1.73	0.308	0.96	0.24	1.25	0.23
Subtotal	6.57	0.862	7.51	1.170	7.20	1.028	10.72	1.629	7.51	1.322	6.32	1.411	5.55	1.003
Gen'l and miscellaneous exp.	6.06	0.801	2.07	0.312	3.78	0.542	4.84	0.735	2.11	0.378	3.28	0.82	1.05	0.19
Total expense	12.63	1.663	9.58	1.482	10.98	1.571	15.56	2.364	9.62	1.70	9.60	2.231	6.60	1.193

writer interprets his text. Colonel Kelly's example is also interpreted to be overhead. He does not give the total distribution investment for the entire company. In his example Colonel Kelly assumes a very high density in the residential class, 200 customers per mile of lines. Allowing for cross streets, this would make the houses almost side by side. If his density were cut to 50 or 100 customers per mile they would then be more comparable with the other examples, except Companies No. 1 and No. 2, using underground construction largely.

Mr. Pike's line investment is based on estimates of cost, not analysis; he finds the costs of overhead wires, etc., by reducing the over-all costs of several companies, principally small ones, to what he thinks is the cost per foot for the usual size wire, and line costs of the residential customer. He also determines the average length of residential circuit by personal observation and averages and reaches his transformer, service and meter costs by adjustment of the costs of a number of companies given in the Public Service Commission reports of the state of New York for all customers to his estimate of the cost for the average domestic customer. Knowing the number of feet of wire and cable in the total distribution system gives little help in deciding the investments in these wires for the several classes of business. They are not given by many commissions and companies in their reports.

The several columns in the upper section of Table I show the total number of customers of all classes of business of each company, where they could be obtained, and the unit cost of distribution per customer. The general and miscellaneous investments are allotted in all cases 80 per cent to distribution, this having been found to be the approximate fact. The percentage of the two distribution costs to the total investment of the companies in their complete plants, less working capital, is also given.

In the lower section of Table I each column then gives the number of kilowatt-hours sold per residential customer and the average number of these customers for the year analyzed. It next gives the total residential distribution investment and its share of the general and miscellaneous investment, with their percentage to the total residential investment. Next is given the detail of this investment in land and structures, lines, services, transformers, meters, utilization, construction materials on hand and the residential share of the general and miscellaneous investment.

The several columns speak for themselves with their own figures, where obtainable. Some items of special note can be mentioned. In Companies No. 1 and No. 2, in view of the great difference in number of residential customers, the unit costs of underground and overhead lines investment combined, shown in the first subtotal line, are in close proportion. In Companies No. 3 and No. 4 and Mr. Reed's example the overhead lines vary as they should with the known physical differences. Colonel Kelly's example would agree, if adjusted to the other low densities of customers per mile of lines. The cost of line per customer might go down, but the cost per transformer per customer might go up, so, for lines, the costs might be as shown in the alternate figure. It will be seen that Mr. Pike's average is somewhat low

for an overhead normal residence customer, but is a good estimate, were averages of any value. Transformer investments per customer vary only a little, services and meters vary quite a bit, particularly where the system is far flung. Taking the total of these three items, Mr. Pike is lowest and Company No. 1 next. Utilization investment, outside of street lighting, and construction materials on hand vary materially in accordance with differing circumstances and conditions.

General and miscellaneous investment in office and distribution buildings and land, communication and transportation investment and other items do not vary a great deal except in Colonel Kelly's and Mr. Pike's figures. It is difficult to tell what Colonel Kelly included here.

The New York companies, whose figures Mr. Pike considered, gave so few examples they can hardly be of any average value. His calculation of this expense, which he combines with utilization, is far too low when compared with actual cases. The last line of each column, giving totals, speaks for itself. Leaving out general and miscellaneous expenses, the investment in companies with long distribution lines is the highest as in Companies No. 3 and No. 4 and Mr. Reed's example.

Colonel Kelly's example is figured for a customer density too high to be comparable for the purposes of this article, but an alternate figure based on half the original density is also given by the writer. Mr. Pike's formula for increasing investment for larger kilowatt-hour consumption over 550 does not work out very well in correcting the difference in the first subtotal line because the investment in overhead lines alone changes more from length of lines and density of customers than from increasing consumption between 550 and 750 kw.-hr. annually.

It is palpably inaccurate to estimate the investment of any one company for any purpose, much less court appraisal or rate base purposes by an estimate or an average derived from others.

Table II takes up the operating expenses of these companies in the same manner as Table I. In this table the total analytical costs are divided by the number of customers and kilowatt-hours and so tabulated. Again, some of the items are not customer costs and some are not kilowatt-hour costs, but, for the same reasons as in Table I, these costs are used.

It will be understood the costs of the upper part of this table are for total distribution costs for all classes of business and the lower part for residential costs only. Neither of these costs includes merchandising losses, uncollectible bills, free lamps and other items of varying policies among companies. Neither table includes taxes and depreciation, which again vary and cannot be accurately apportioned to distribution accounts alone. There is little comparison to be made in the upper portion of the table, the unit costs vary on account of the volume of all business done over all lines in one company against another. The number of customers and kilowatt-hours vary greatly in these examples. In some cases a very large wholesale and bulk business is done, in others not nearly so much.

In the lower part of this table showing the residential distribution costs only, in lines cost, it is found that there is fair proportional comparison when the difference in conditions is considered. Company No. 4, with very low customer density and far-flung lines, is much higher than the others. Colonel Kelly's operation costs for meters and services are not given separately in his article, but are probably included in the other costs. Colonel Kelly states his operating costs were those of a large company and, in consequence, he thinks they are low. Mr. Pike's operating costs for lines, transformers, services and meters are not separated clearly in his paper, but his total for the four items is shown.

When we combine lines operating costs with those of transformers, services and meters on the first subtotal line a further comparison can be made with about the same result in variation. Companies No. 2 and No. 4 are high per customer or per kilowatt-hour due to long lines. Companies No. 1 and No. 3, Mr. Reed, Colonel Kelly and Mr. Pike are fairly close together. Colonel Kelly's may not include meter and service operating expense. Utilization costs vary, but except Company No. 4 are materially higher than Mr. Pike's example, the latter evidently caused by insufficient data, as all utilities are tending toward more servicing and free wiring. Commercial and new-business expenses vary with company policy. Little comparison can be made, except that Colonel Kelly and Mr. Pike allow but little for these expenses in their examples.

General and miscellaneous expenses also vary in the same way with company policies, and in this case Colonel Reed's example is low and Mr. Pike's again much too low, probably from insufficient residential class data in his base company figures. Again in the total residential operating expenses it will be seen wide differences exist, but the lowest is nearly 50 per cent above Mr. Pike's estimates average. This shows again, that

estimates or averages cannot be used to obtain the true operating expenses any better than they can be used to obtain the true residential investment costs for any individual company.

In an attempt to obtain clear-cut comparisons the

Table III—Comparison of Costs With Miscellaneous Items Included

No.	Kw.-Hr. per Res. Cust. Annually Per Customer 1	Inv. in Res. Dist'bn Only Per Customer 2	Res. Dist'bn Oper. Only Per Kw.-Hr. 3	All* Resid. Oper. Costs as Listed Per Kw.-Hr. 4	Ret. at 7% on Total Res. Inves. Per Kw.-Hr. 5	Ret. Plus Total Res. Oper. Ex. Per Kw.-Hr. 6	Diff. Between Pure Res. Dist. and Total Exp. Without Ret. Col. 4-Co.3 Per Kw.-Hr. 7
			Cents				
Company 1	757	$65.00	1.663	3.32	1.32	4.64	1.657
Company 2	643.5	59.00	1.482	3.43	1.24	4.67	1.948
Company 3	700	73.00	1.571	2.82	1.60	4.42	1.25
Company 4	658	87.00	2.364	3.32	1.85	5.17	0.956
Mr. Reed's example	560	84.00	1.700	3.60	1.83	5.44	1.90
Colonel Kelly's example	400	42.50 or 53.50	2.231	....	....	5.83 or 6.57	....
Mr. Pike's extimate	550	55.00	1.193	....	....	2.36	1.154

*Include taxes and depreciation.

tables given show only pure distribution costs from the point where the distribution lines leave the substation to and including the meter. To get comparable figures to, say, Marshall and Snow's paper on residential costs per kilowatt-hour many items must be added, notably the residential share of generation, transmission, substation, free lamps, loss in merchandising, uncollectible bills, branch offices, taxes and depreciation and return on investment and working capital.

On a per kilowatt-hour basis these accounts are included and the differences are shown in Table III.

The last column shows the variation existing in other items of total over-all distribution residence expenses in addition to the variation in pure distribution residence expenses. This confirms the practical fact that averages are of little value when applied to individual cases. They are like dead reckoning at sea without an observation of the sun.

Motor Rebanded in Place With Shop-Made Device

By G. R. PARDEY
New York Service Department,
Westinghouse Electric & Manufacturing Company

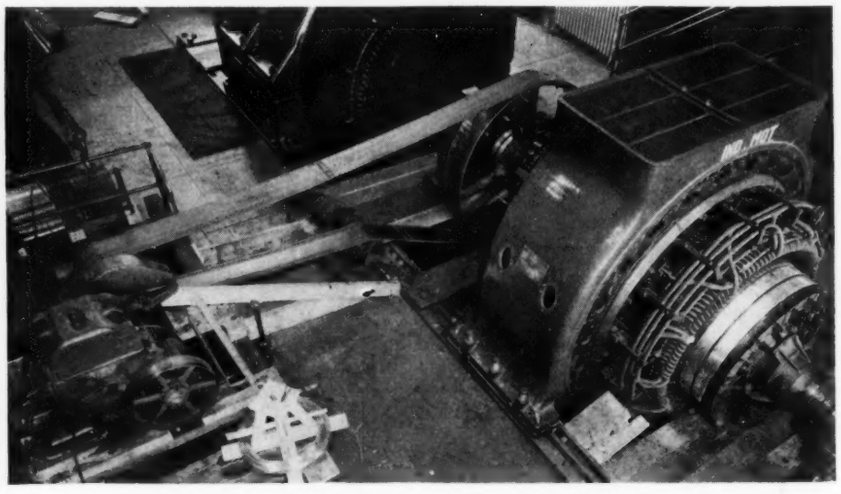
When it became necessary to reband a 7,200-hp., 750-r.p.m. CW motor that had been operating under severe service conditions for a number of years, it would have been extremely expensive to dismantle the entire frequency changer set of which this motor was a part and remove the rotor weighing around 35 tons to a shop having a lathe large enough to handle it. It was accordingly decided to do the work with the rotor in its own bearings, and this meant that a suitable method of turning it had to be devised.

The requirements of such a drive are rather special. High torque must be developed at a low speed, in this case some 2,500 lb.-ft. at from 4 to 6 r.p.m. Since the diameter of the rotor where the bands are applied is approximately 5 ft., a speed of 4 r.p.m. means a peripheral speed between 60 and 65 ft. per minute. In addition, during the banding operation, the rotor must be started and stopped frequently without the slightest loss of tension in the banding wire. The starting torque must be sufficient to start the heavy rotor from rest and means must also be provided to stop within one revolution of the rotor.

On this particular machine the banding is exceptionally heavy, due to high peripheral speed of the rotor. On each end there are two triple layer bands of steel wire, 51 turns per layer, with mica tape insulation between layers to cut down band heating. In all 10,000 ft. of banding wire is required.

The set-up to accomplish this job was simple, comparatively cheap and remarkably effective. The general arrangement is illustrated. The driving motor is a type 30 V, 650-volt, 55-hp. railway motor assembled with its original gears having a 15-69 ratio and a car axle with a 20-in. pulley. The large pulley on the shaft of the motor under repair was made from a locomotive driver. A resistance of 1.22 ohms was connected in parallel across the armature to obtain high torque with low running speed. The brake, as first tried out, was applied to the driving motor back gear shaft, but this was not satisfactory on account of slippage and stretch of the driving belt. Accordingly the brake was finally built to act on the large pulley directly on the motor shaft. The brake was made of 2x12-in. plank reinforced with a heavy oaken brake shoe operating on the belt on the pulley. Leverage applied by an oak timber on signal enabled the holding of the rotor without backlash against the pull of the banding wire served through a friction tension device.

The whole arrangement functioned admirably and an excellent banding job was secured at minimum cost.



This arrangement for motor banding gave excellent results with small outlay

Expense of a $400 split pulley was obviated by removing the spokes from a locomotive driving wheel, together with counterbalance and crankpin fit; it was cut in four parts and bolts provided through hub to hold it together; hub was bored out to fit the shaft and shortened to fit the space between coupling flange and bearing housing. Pulley rim was made of ½-in. steel plate, and the whole secured to the motor shaft by pins which engaged holes in half-flange coupling and hub holes. Entire cost of pulley was $100 in place.

Sight Meter Helps Public Sell Itself on Lighting

A utility in the Pacific Northwest purchased a number of sight meters for each of its district offices and advertised to its consumers that these meters could be borrowed to check their lighting. Results were immediate and there is a continuous waiting list of people interested in checking the lighting in their homes and stores. Many consumers have sold themselves on the need for increased lighting in their establishments. Experience has shown that, upon returning the meter, the customer will purchase lamps of a larger wattage or, in the case of small shops and offices, announce themselves as prospects for a lighting survey of their premises.

Quality of Piped Water Unimpaired by Grounding

By H. S. WARREN
Director of Protection Development, Bell Telephone Laboratories, Inc.

As the result of considerable investigation Mr. Warren is of the opinion that recent sensational charges of impaired water supplies are without demonstrable basis.

IN SOME cases water companies receiving customer complaints as to quality of water have suspected that current on pipes from power, radio or other electrical grounds might have caused impairment of the water. In one such case investigations are in progress to determine whether these suspicions are well founded, but the results are not yet available. Speaking solely on my own responsibility,* however, I can indicate some of the reasons for my belief that protective grounding, in accordance with the National Electrical Code, does not affect the water in pipes which may be used as grounding electrodes.

In connection with electrolysis investigations, it has been found that any injury to pipes by corrosion is limited to places where the current leaves the pipe directly to earth by electrolytic conduction. With alternating current the corrosive effect is less than 1 per cent that of direct current. Even if it be assumed that any considerable fraction of the current along a water pipe is conducted by the water in the pipe itself, there is no reason to think that this would harm the water. Pure distilled water is virtually a non-conductor. If the water contains sufficient other material to make it conducting, a very small part of the water might be decomposed into oxygen and hydrogen gases, but this should not injure the remainder of the water.

Water conduction low

A simple computation will show how much current will get into the water in a pipe due to the presence of current on the pipe. Assume a $\frac{3}{4}$-in. standard welded steel pipe and water of 4,000 ohm-centimeter resistivity, a value which is within the range of commercial water supplies. The resistivity of iron and steel has quite a range of values as between different samples, but 11 microhm-centimeters represents a fair value for standard transformer steel. One ampere of direct current on the pipe would mean a voltage drop of 156 microvolts per foot of pipe. With water of the assumed resistivity, the resistance of a water column of 0.533 sq.in. cross-section and 1 ft. long is 35,500 ohms. The same voltage drop in the water as in the pipe would, therefore, correspond to a current of 4.4×10^{-9} amp., or less than one-half of 1/1,000,000 of 1 per cent of the current in the pipe.

In the case of alternating current, the proportion of current in the water would be even less.

From a paper before the New England Water Works Association.

It is interesting to compare the current in the water due to current along the pipe with the current set up in water by a galvanic couple. For this purpose our protection standards engineer conducted an experiment with short pieces of brass and galvanized iron pipes, fastened together by insulating cement so that there was a separation of about 0.04 in. between the brass and the iron. By mounting these pipes vertically in glass vessels and capping the lower end it was possible to add water and observe by means of a microammeter the current between the dissimilar metals. New York City tap water was used, a small amount of potassium chloride being added to bring its resistivity down to 4,000 ohm-centimeters. The resulting galvanic current was found to be 220 microamperes. By comparing this with the results of the above computation, we find that the galvanic couple introduced 50,000 times as much current in the water as would one ampere of direct current on the pipe.

	Pipe	Coupling	Pipe
1	Brass	Brass	Brass
2	Galv. iron	Galv. iron	Galv. iron
3	Galv. iron	Brass	Brass

Pipe coupling arrangement for longitudinal current tests

Pipe Coupling Test

Weight of Corrosion Sediment After 22 Days

Coupling	Current	Sediment, Mg.
Brass	None	6
Brass	1.0 amp. a.c.	5
Brass	1.0 amp. d.c.	7
Iron	None	180
Iron	1.0 amp. a.c.	160
Iron	1.0 amp. d.c.	153
Iron	None	703
Brass	1.0 amp. a.c.	158
Brass	(a) 1.0 amp. d.c.	151
	(b) 1.0 amp. d.c.	164

(a) Brass positive. (b) Brass negative.

Another test was made with cells containing short pieces of pipe joined together by a coupling, the object being to see whether current longitudinally through the samples would affect the rate of corrosion. In some cells the two pieces of pipe were alike, both iron or both brass, and in other cells a brass pipe was coupled to an iron pipe. Each type of cell was arranged in three groups, one with no superposed current, one with an ampere of superposed alternating current and one with an ampere of superposed direct current. The results obtained, after a 22-day run, are shown in the accompanying table.

It will be seen that the current had no appreciable effect.

Considerations such as these, together with the fact that protective grounding introduces either no current at all, or at most very little current, even on the pipe itself, seem to constitute strong evidence that no harm to water supply can result, unless possibly under some very extraordinary condition. If, as a result of the examinations which are being, or may be made, it should be found that, from the standpoint of the water companies, any changes in the grounding provisions of the National Electrical Code are desirable, I have no doubt that any reasonable modifications necessary to meet these conditions could be worked out and incorporated in the code.

We Check All Major Faults

Plan Followed and Some Experience Obtained at Milwaukee in the Analysis of All Major System Faults with a Modern Oscillograph

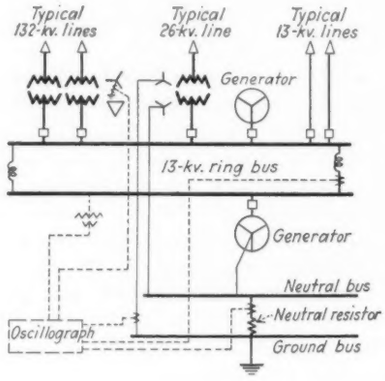
By E. L. McCLURE

Assistant System Engineer
Milwaukee Electric Railway & Light Company

OBVIOUSLY the oscillograph is the correct instrument for obtaining records during faults, but one for each major line or piece of equipment is out of the question from the cost standpoint. Consequently few have been installed in spite of automatic starting, which makes them especially applicable for power system analysis. A scheme for using a modern automatic oscillograph at a large power plant for recording faults on all major lines and pieces of equipment has been developed.

The plant at which this oscillograph is applied has an arrangement as shown in the diagram. The bus itself forms the so-called "ring" with reactors in the two ties. Twelve Y-connected generators are operated on this bus, one of which has its neutral grounded through a three-ohm resistor. A current transformer in the resistor circuit supplies current for records and for starting the oscillograph during any appreciable 13-kv. ground fault. Since this current is normally of negligible value, a rather low setting is used on the initiating relay. The proportion of system ground faults covered by this connection is evident when we consider the fact that out of a total of 38 feeders from this station 26 are at 13 kv. It is also obvious that for any ground fault on 13-kv. equipment in the plant a record of the current will be obtained.

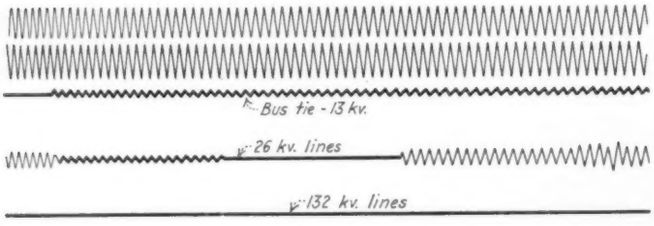
From the diagram it is plain that any ground faults on the 26-kv. system will also start the oscillograph and produce a record of fault current. Since the current in the common 26-kv. neutral return is also small, a low current setting is also used on the initiating relay. One of the six 132-kv. lines has an exposure equal to 64 per cent of the total 132-kv. exposure on the entire system (420 miles in all). Since there is no common neutral return for this system the grounded neutral on this long line has been used as shown.



How faults on three different voltage systems are obtained on one record is shown by this simplified diagram of the oscillograph connection

Phase-to-phase faults, although not as prevalent as phase-to-ground faults, are nevertheless a large percentage of the total number. Such faults would provide no current for records or initiation by means of the ground connections. Therefore, current for starting the oscillograph and for producing a record on phase-to-phase faults is obtained from one of the bus ties as indicated.

Whenever a phase-to-phase fault occurs on lines or equipment connected to either side of the ring bus it is clear that generators on the opposite side of the ring will supply fault current through the ties. Since this current will be unbalanced on the A, B and C phases, a negative phase sequence network is used. This network—connected to the secondaries of current transformers—supplies current to the oscillograph only when the current through the tie is unbalanced. By means of this arrangement the oscillograph functions for all major phase-to-phase faults on the 26-kv. and 132-kv.



Much information in one record

This oscillogram was obtained when a 26-kv. line opened due to a lightning flashover. In addition to the 26-kv. ground current that was expected the record also shows 13-kv. ground current. In fact, the movement of the arc from a 26-kv. ground flashover to a 26-kv. phase-to-phase arc and finally to a 26- and 13-kv. ground flashover can be readily recognized. Subsequent analysis led to the conclusion that one of the 13-kv. service breakers, into a customer having two-line service, must have opened. A check showed this to be true, although no report had been received. Closing the breaker, therefore, restored normal two-line service to this customer and thus avoided a possible future outage.

Oscillographic fault analysis is not new, but Mr. McClure shows here how a single instrument may be used to secure a complete fault analysis of many system elements. Experience has afforded much information on obscure disturbances and apparatus failures as well as for checking protective equipment and selecting faulty links in the system. In one case proof of the operator's alert judgment was obtained which might otherwise have been disputed, by company and customer alike.

systems as well as those on the 13-kv. system. It is interesting to note that a partial record of 132-kv. ground faults, not covered by the 132-kv. neutral previously referred to, is also obtained by this method.

Balanced faults are rare

No provision has been made for starting the oscillograph on any fault which is balanced on all three phases. Experience has shown such faults to be quite rare. They may occur, but in most all cases they will be started by phase-to-ground or phase- to-phase faults which are covered by the arrangement shown. Since two of the oscillograph elements are used to record A and B phase bus voltage, it is possible to determine the duration of those three-phase faults which develop.

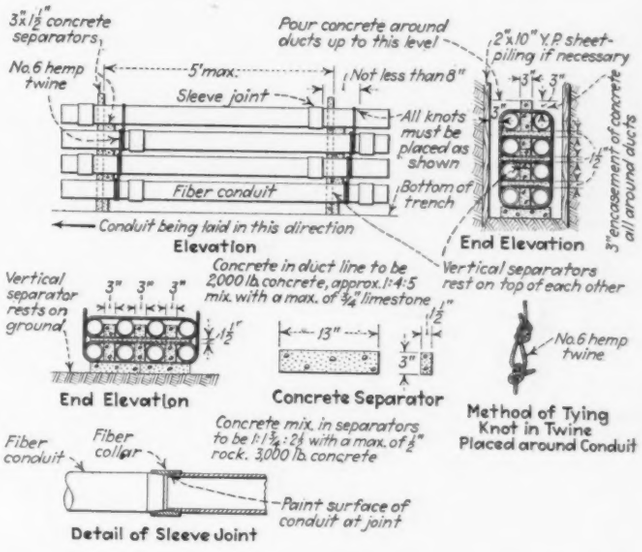
From the foregoing it will be noted that six records are produced simultaneously by the oscillograph. These are arranged on the film in the order of A phase bus voltage (phase to neutral), B phase bus voltage (phase to neutral), negative phase sequence current in bus tie, 26-kv. ground current, 132-kv. ground current, 13-kv. ground current.

To date there have been 55 records produced by the oscillograph. The type of fault and its duration are shown very definitely. These data, together with the magnitude of fault current, have produced valuable checks on the operation of oil circuit breakers and relays which have cleared faults from the system. The record produced during a failure of a 13- to 132-kv. step-up transformer showed clearly that both windings of the transformer were involved, as well as the location of the fault in the 13-kv. winding. Without the record a fault in the high-voltage winding alone might have been suspected.

The failure of a generator oil circuit breaker mechanism at one time caused a generator to be cut in without being synchronized. While this machine was attempting to pull into step only balanced power would be expected to flow. The oscillograph, however, showed a badly unbalanced current and suggested a check of oil circuit breaker contacts. The badly burned contacts on two phases might otherwise have caused subsequent trouble. It is interesting to note in this particular case that the record showed the operator's alertness in reacting to the situation. The generator oil circuit breaker was tripped in 4.04 seconds. This short time, however, produced an oscillogram 39 in. in length, which justified the operator's action.

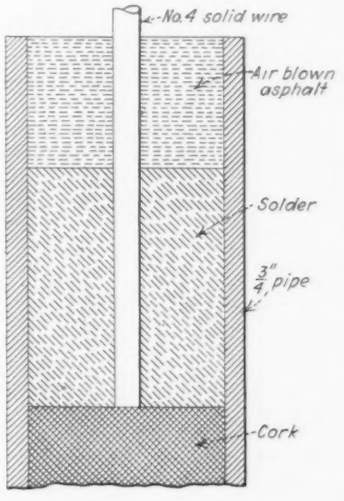
The oscillograph as applied here has afforded much information for checking protective equipment. Unusual cases have told unexpected things that have happened within split seconds during which faults existed. All this material would have been lost without the oscillograph. In all cases the records lead toward improved operating and protective methods and consequently improved service to our customers.

Better Ways to Install Fiber Conduit


3"x1½" concrete separators
Pour concrete around ducts up to this level
2"x10" Y.P. sheet-piling if necessary
No.6 hemp twine
5' max.
Not less than 8"
Sleeve joint
All knots must be placed as shown
Fiber conduit
Bottom of trench
Conduit being laid in this direction
Elevation
End Elevation
3" encasement of concrete all around ducts
Concrete in duct line to be 2,000 lb. concrete, approx. 1:4:5 mix. with a max. of ¾" limestone
Vertical separators rest on top of each other
Vertical separator rests on ground
End Elevation
Concrete Separator
No.6 hemp twine
Method of Tying Knot in Twine Placed around Conduit
Concrete mix. in separators to be 1:1¾:2½ with a max. of ½" rock. 3,000 lb. concrete
Fiber conduit
Fiber collar
Paint surface of conduit at joint
Detail of Sleeve Joint

Fiber conduit has many applications and the accompanying illustrations show installation practices of the Kansas City Power & Light Company.

Gas Pipe Ground Practice



Gas pipe grounds are still much used. But there are differences of opinion as to their economy contrasted to the use of other types such as copper-weld rods. The illustration shows the ground wire connection at the top of the pipe used by one utility. In other instances a patent clamp is used as it is claimed to be less expensive and more flexible for making changes. For driving the rod in some instances patent or home-made cones or points are inserted. In other instances the end of the pipe is simply crushed to give a chisel effect. There is little standardization in practice in the use of gas pipe grounds and work is going on to get more data on this and other types of ground so as better to determine costs and performance.

The British Grid

An Authoritative and Condensed Summary of Plan and Accomplishment That Should Be of Great Interest to American Readers

IT IS claimed for the grid that it is the first and by far the greatest example of complete planning of a national utility service in any country in the world. The need for electrical reorganization was especially emphasized during the war, when it was found that one of the greatest weaknesses in harnessing manufacturing processes for large scale production was the lack of co-ordination between electricity supply undertakings, the disparity between generating plant capacities and power loads, both territorial and technical, and, as a result, the impossibility of making the fullest use of the electrical power equipment scattered all over the country.

In 1925 the government of the day appointed a committee, presided over by Lord Weir, to review the whole problem and to report on the policy that should be adopted to insure the most efficient and effective development of the supply of electricity. The outcome of the recommendations of the Weir committee was the passing of the electricity (supply) act, 1926, by which the Central Electricity Board was set up to construct and operate the grid. For the purposes of the construction program the country was divided into ten main areas, namely, north Scotland, central Scotland, south Scotland, northeast England, northwest England and north Wales, mid-east England, central England, east England, southeast England and southwest England and south Wales, and for each of these areas, except north Scotland, regional schemes, so conceived and designed that they would dovetail into each other to complete the greater national plan, were prepared.

When the board was constituted and began its work, early in 1927, electricity for public supply was produced in approximately 500 generating stations belonging to authorized undertakers throughout the country, and the total number of selected stations in the complete scheme is 135. At present there are 122 selected stations in the system, provision having been made for the construction of the additional thirteen as and when required. There are 273 switching and transforming stations for connecting the grid to the selected stations and the systems of other authorized undertakers. Of the initial 4,000 miles of transmission lines, about 3,000 miles operate 132,000 volts and about 1,000 miles at 66,000 and lower voltages. The whole efficiency of the grid system is dependent upon the exercise of effective control of generation and transmission, and this has been provided for by the establishment at strategic points in each regional area of a fully equipped control room, connected by private telephone lines to all the generating stations and switching stations in the area. Construction of the grid, which throughout has been ahead of the contemplated program, occupied, roughly, five years and the cost has been approximately £27,000,000.

The British Grid as it was initially planned is now complete and practically the whole of the 4,000 miles of transmission lines, which link up the selected generating stations with each other and with the distribution systems of other electricity undertakers, are in commission. Next year the Central Electricity Board, which owns and operates the system, expects to be engaged in general trading throughout the whole country, with the exception of the northern half of Scotland, not yet embraced in the national scheme.

Authority of the board

The Central Electricity Board, which comprises a chairman and seven other members, is a statutory body appointed by the Minister of Transport, but is not a government department. It is not immediately responsible to Parliament, nor is it under obligation to submit detailed estimates of the cost of administration for approval by the Treasury or any other government department. In common with other electricity supply authorities, however, it is subject to the general statutory limitations governing electricity supply, so far as these are appropriate to its activities and responsibility, and it must submit an annual report to the Minister of Transport, which is presented to Parliament.

The board's trading is confined to dealing in electricity in bulk with authorized distributing authorities (both company and municipal) and it does not supply directly to retail consumers. The board has no ownership in their productive assets, namely, the selected generating stations. These belong to and remain the property of the individual supply undertakers, but the undertakers are under obligation to regulate the output of the stations in accordance with the instructions of the board and to operate them with due regard to economy and efficiency, the board paying the charges on the stations, which in the case of the company-owned stations are defined within certain limits. Subject to those obligations, the owners of the selected stations employ their own labor, purchase their own materials and generally establish their own conditions of operation. On the one hand, the board concentrates on the realization of the

highest standards of efficiency and reliability, combined with economy in the generation and main transmission of electricity. On the other hand, the supply undertakers, the majority of whom are relieved of the necessity to deal with this phase, involving all the technical problems of generation, are better able to concentrate on distribution and service to the consumer. Moreover, they are freed from the responsibility of financing the erection and extension of generating stations and of maintaining an excess of reserve plant and can employ their resources and experience in extending their distribution systems and developing new load in the most efficient and enterprising way possible.

Experiences now available

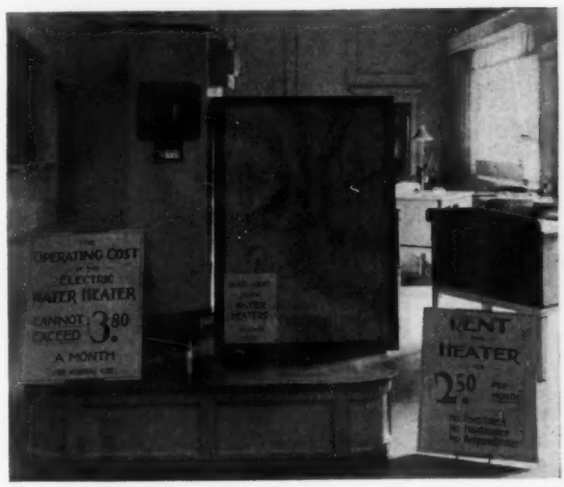
The board has now had some experience of the grid in actual operation. The first section of transmission lines was put into service in central Scotland early in 1930, and at the beginning of April, 1934, general trading, as provided for by the 1926 act, was in progress in six areas aggregating over 41,000 square miles, supporting a population of approximately 35,000,000 people, or 78 per cent of the entire population of Great Britain. Grid tariffs were brought into force in central Scotland and mid-east England on January 1, 1933, in southeast England and east England and in northwest England and north Wales on January 1, 1934, and in central England on April 1, 1934. In its last annual report the board, reviewing the first year's general trading in the two first-named areas, stated that the growth of demand had exceeded the estimates of growth made by the board when framing the tariffs for these areas, and that the year's trading had produced financial results which were most encouraging. It also stated that the adoption of operating programs, on the principle of allocating the maximum output to those stations having the lowest running cost, and thus insuring the lowest aggregate cost of production, resulted in 76 per cent of the total units supplied by the board being produced at ten out of the 25 coal-fired selected stations in those areas with substantial resulting economies. Further, owing to the smaller proportion of spare plant required for an interconnected system, it was possible to meet the whole of the growth of demand in the two areas without any capital expenditure having to be incurred on generating plant extensions such as would have been necessary without the interconnection provided by the grid. Thus the grid reduces the cost of power supplies to distributing undertakers and makes the supply industry more competitive against alternative sources of power. It is thereby accelerating the modernization of industry and performing an important national economic service. Through the pooling of energy supplies, the grid is making it certain that the economies, which hitherto have been confined to the very large centers of demand, will be spread over the whole country, leading ultimately to better territorial distribution of economic activity. The range of supply has widened and, in fact, very few parts of Great Britain will now be incapable of intensive electrical development.

Decentralization of industry possible

Electrification of industry is making rapid strides, and as a result of the mobility of electric power brought about by the grid new factories are being established in localities away from the older production centers. The most notable example of this kind of development is provided by the transference of the great steel works of Messrs. Stewarts & Lloyds from Scotland to a comparatively undeveloped area at Corby, Northamptonshire, in the central England area. The new modern steel works now in course of erection there are to be all electric, the power supplies, which will far exceed the whole of the other requirements of the local public supply undertaking, being based on the grid. Intensive electrical development in many rural areas has also accompanied the development of the grid and it has been part of the policy of the Central Board in the planning of its secondary lines to have special regard to the accessibility of supplies to areas where facilities for enjoying the advantages of electricity might otherwise be deferred.

The grid system as at present constructed is designed to deal with an assumed annual output up to the year 1940 of 25,000,000,000 units, equivalent to about 500 units per head of the population. Last year authorized electricity undertakings in Great Britain generated over 13,500,000,000 units of electricity, and during the first four months of the present year the growth has been nearly 20 per cent, a rate of increase which holds good promise of the realization of the achievement aimed at within the first ten-year budgetary period for which the grid tariffs of the Central Electricity Board have been framed.

To Make Hartford Citizens "Water Heating Conscious"



That off-peak electric water heating is economical and far beyond the experimental stage is effectively set forth to visitors to the main office of the Hartford Electric Light Company by the display illustrated above. More than 1,030 such heaters are now in service and the location of many is spotted on a map of the city shown at the right of a typical 60-gal. heater with insulation cut away to show the time switch controls of the two 2-kw. heating elements provided at the top and bottom of the tank. Off-peak energy at 1 cent per kilowatt-hour and the company's monthly rental plan previously described in ELECTRICAL WORLD have gone far to popularize this service.

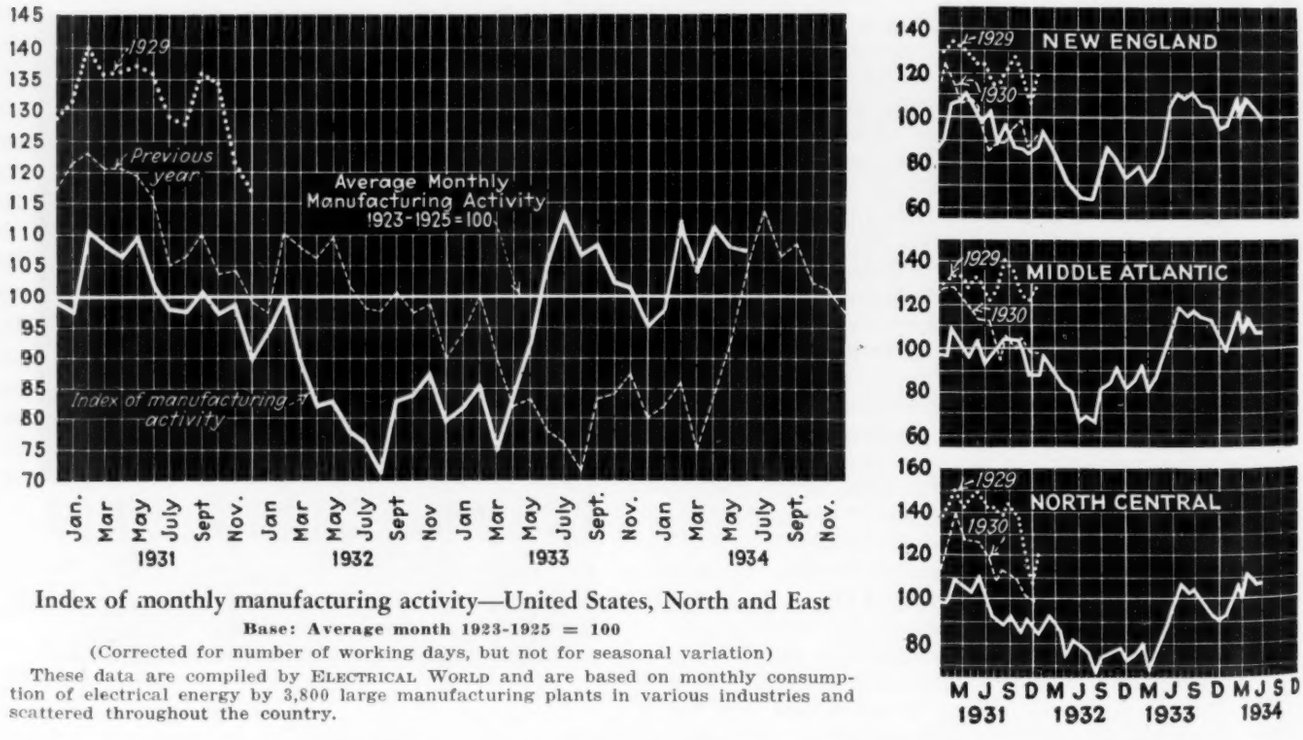
June Operations Close to May

Electrical World's monthly survey of electrical energy consumption by various industry groups during June reveals moderate changes, with a general average 3 per cent under that of May, and 3 per cent above June, 1933. Despite moderate recessions, automobiles, iron and steel, and metal working are far above last year's operations. Foods, chemicals and leather products advanced, but textiles continued downward.

JUNE operations of manufacturing plants were on nearly the same scale as in May, moderate recessions in certain lines of industry being nearly balanced by gains in others. Based on ELECTRICAL WORLD's monthly survey of electrical energy consumption a decline of 3 per cent is shown in the weighted average compared with May and a gain of equal amount over June, 1933.

Activity in iron and steel is higher than in any previous month of the year except May and the recession from that month is small. The gain over the rate of operations a year ago amounts to 23 per cent. The same statements apply to the metal-working industry, which consists mainly in the manufacture of machinery. Two others in the durable goods group, namely, forest products and the stone-clay-glass industries, had previously made considerable progress and are now approximately at the level attained a year ago.

In food products the usual seasonal rise has been in progress, but on a somewhat lower level than a year ago, the difference in June being 7 per cent, while in the chemical industries, including oil refining, energy consumption has for several months been approximately constant and materially larger than in 1933. In automobiles and textiles the past two months show a decline, but the former stands with a net gain of 30 per cent over last year, against a net loss of 22 per cent in textiles.


1929
Previous year
Average Monthly Manufacturing Activity 1923-1925=100
Index of manufacturing activity
NEW ENGLAND
MIDDLE ATLANTIC
NORTH CENTRAL
1930
Jan. Mar May July Sept Nov Jan Mar May July Sept Nov Jan Mar May July Sept. Nov. Jan Mar May July Sept. Nov.
1931 1932 1933 1934
M J S D M J S D M J S D M J S D

Index of monthly manufacturing activity—United States, North and East

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

Industrial Groups	United States June, 1934	United States May, 1934	United States April, 1934	United States June, 1933	New England June, 1934	New England May, 1934	New England April, 1934	New England June, 1933	Middle Atlantic June, 1934	Middle Atlantic May, 1934	Middle Atlantic April, 1934	Middle Atlantic June, 1933	North Central June, 1934	North Central May, 1934	North Central April, 1934	North Central June, 1933
All Industry	**107.2**	**110.2***	**111.0**	**104.5**	**98.0**	**104.2**	**108.7**	**104.7**	**108.1**	**108.0***	**112.0**	**108.8**	**107.5**	**109.3***	**111.0**	**97.8**
Automobile (incl. parts and accessories)	85.7	90.2	101.0	65.5	.....	.....	.....	.....	69.0	75.8*	90.7	64.0	87.1	90.8	102.1	65.8
Chemical products (incl. oil refining)	161.0	158.0*	160.5	135.7	168.6	179.5	186.4	163.0	176.4	178.0*	176.5	143.0	126.2	125.4*	131.0	129.4
Food products	126.8	124.5*	116.0	136.0	.....	.....	.....	.....	134.2	133.0*	121.0	147.4	125.1	121.2	111.7	131.4
Iron and steel	98.6	102.1*	96.0	79.8	133.0	142.1*	135.2	135.7	80.0	83.3	81.7	65.5	107.0	110.0*	102.2	86.8
Metal working	89.7	92.3*	90.1	72.6	108.9	113.2*	118.0	99.5	80.2	78.8*	75.5	63.0	95.3	103.4*	101.5	77.5
Metals group	93.0	95.9*	92.3	75.3	115.9	121.3*	123.2	109.6	80.1	80.8*	78.2	64.1	99.7	105.8*	101.8	81.0
Leather products	96.0	93.2	104.0	100.2	72.5	76.1*	96.8	90.8	124.5	105.8*	112.7	124.8	89.4	94.7	99.8	84.4
Forest products	100.0	106.5*	107.7*	98.3	48.7	47.7	46.1	48.6	67.2	67.2*	62.3	61.7	87.5	90.5	89.7	93.2
Paper and pulp	122.0	125.7*	126.8	126.5	118.6	133.0	129.3	117.3	103.0	102.5	107.2	99.5	110.4	111.2*	114.8	123.0
Rubber products	136.2	143.0	143.0	146.4	117.8	118.1	111.0	138.2	.....	.....	.....	.....	143.3	152.2	151.2	146.0
Shipbuilding	87.1	81.3*	80.2	75.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stone, clay and glass	100.1	107.3*	105.3*	102.0	.....	.....	.....	.....	87.7	97.3*	82.8	87.6	105.3	112.3*	128.6	112.4
Textiles	92.2	100.0*	109.6	118.2	71.0	76.7*	84.1	90.8	114.2	112.7*	135.5	146.0	143.1	128.7	145.0	119.5

*Revision.

The very definite gains in connection with the manufacture of durable goods are important. It was in this field that the decline was most pronounced and it is here that renewed activity is regarded as most essential to general recovery. As to the figures on the chemical industry, it is to be noted that on the basis of energy used by the reporting companies this group is on a higher level than in any other year covered by these statistics.

Textiles down in East, automobiles in North Central area

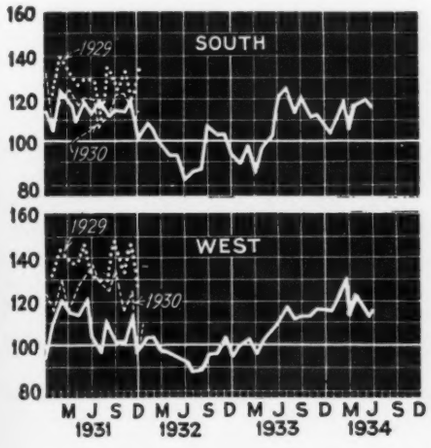
In New England activity in the textile industry decreased in May and again in June, the present rate being 22 per cent less than in June of 1933, but slightly greater than in May of that year. Iron and steel, receding from the preceding month, is on a par with April and with June, 1933, but in metal working there is a year's gain of 9 per cent. Both industries have approximately doubled their use of energy compared with the low point in 1932. The regional average fell 6 per cent from May.

In the Middle Atlantic states most of the changes were negligible. Leather gained, automobiles and stone lost, the average remained unchanged and almost identical with that attained a year ago. With a number of important returns still missing, some of the figures are subject to revision. The North Central average shows a year's gain of 10 per cent, notwithstanding the sharp advance at this time last year. Recessions are indicated in the metal industries, leather products, stone, and, to a less degree, in automobile, with an increase in textiles.

Textiles recede in South

Labor troubles are reflected in a severe decrease in energy consumption by textile mills in the South, but the loss was in part compensated by an advance of 19 per cent in the stone, clay and glass industries. The regional average is the same as in April, and down 3 per cent from last year.

In the West the only important change was in forest products, which declined 8 per cent. Smaller changes in other industries, in part counteracted by a further rise in metals, caused a decrease of 3 per cent in the general average, leaving a gain of the same magnitude over last year's June.



Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

	South				West			
Industrial Groups	June, 1934	May, 1934	April, 1934	June, 1933	June, 1934	May, 1934	April, 1934	June, 1933
All Industry	**117.3**	**120.0***	**117.0**	**121.3**	**115.0**	**118.4***	**121.4**	**111.6**
Chemical products	168.5	155.1*	160.0*	147.4	94.0	90.5*	91.7	74.7
Food products	161.0	166.0*	142.1	163.4	105.7	107.9*	117.3	126.0
Iron and steel	181.0	185.0	155.2	127.1	.....	.....	.....	.....
Metal working	111.6	105.0	92.2	88.5	.....	.....	.....	.....
Metals group	150.3	149.4	127.4	110.0	84.4	91.2*	78.7	62.2
Forest products	48.1	46.0	46.7	49.6	156.5	169.5*	175.0	154.0
Paper and pulp	151.5	156.1	152.0	167.5	171.5	178.6	168.5	159.7
Rubber products	79.0	83.0*	92.5*	146.3	107.4	109.1	117.0	106.0
Shipbuilding	.....	.....	.....	.....	98.3	100.3*	95.6	107.2
Stone, clay and glass	142.0	119.0*	137.2	137.0	120.4	127.2	121.2	107.8
Textiles	103.9	123.7*	130.2*	146.3	.....	.....	.....	.....

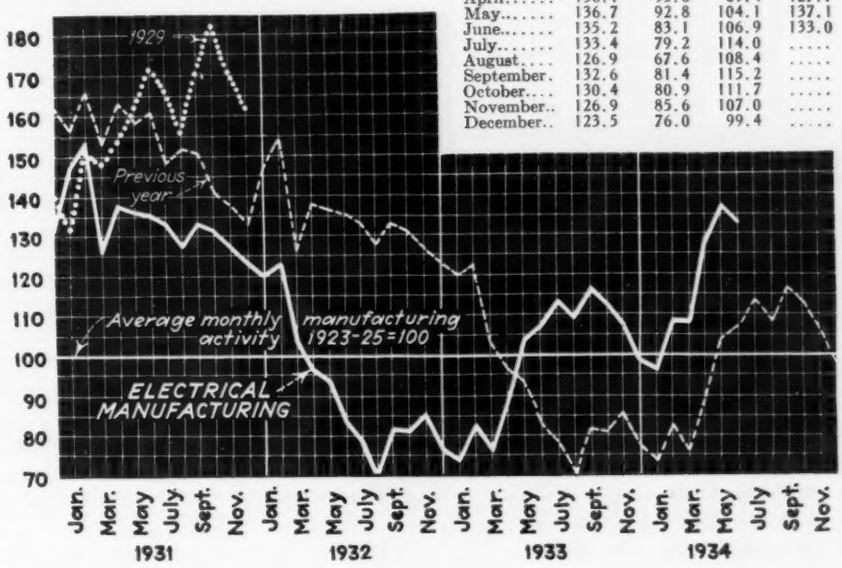
*Revision.

Sustained Gains in Electrical Manufacturing

Energy consumption in the manufacture of electrical goods shows that the increased rate of operations, which brought the index number for May to the highest point since the summer of 1931, was virtually sustained during June. Returns thus far received point to a recession of 3 per cent, but the figure remains higher than that for April and for every other month since the upward movement began. It is almost 100 per cent above the minimum, recorded in August, 1932, and 24 per cent above last year's June.

In the eastern part of the country the aggregate figures were close to those for May, some of the constituent reports indicating moderate deviations. In the Central States there was some slackening of operations, especially in the manufacture of appliances, although some companies show decided gains.

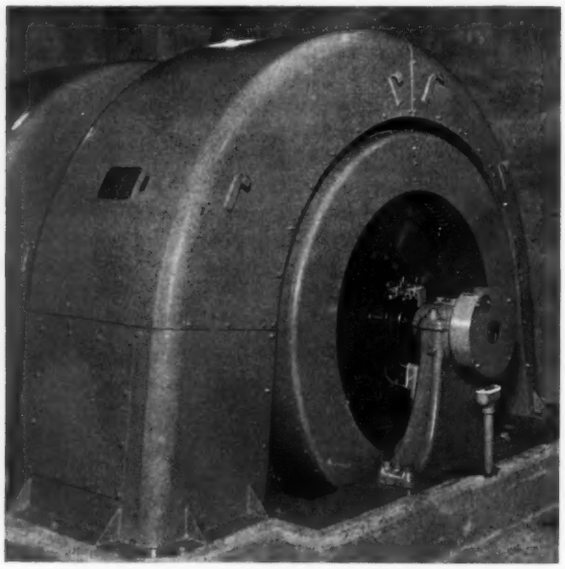
Monthly index of electrical manufacturing activity



(Index adjusted for 26 working days)

	1931	1932	1933	1934
January	146.6	120.0	74.0	97.1
February	154.3	122.2	83.3	108.2
March	126.1	102.9	75.0	108.1
April	138.1	95.6	89.4	127.7
May	136.7	92.8	104.1	137.1
June	135.2	83.1	106.9	133.0
July	133.4	79.2	114.0	.....
August	126.9	67.6	108.4	.....
September	132.6	81.4	115.2	.....
October	130.4	80.9	111.7	.....
November	126.9	85.6	107.0	.....
December	123.5	76.0	99.4	.....

Motor-Generator Sets Made Self-ventilating



Drawing air through housing ends and exhausting it below, this 1,000-kw. motor-generator is self-cooling

Location of several motor-generator sets underground at the Cleveland mill of the Chase Brass & Copper Company presented a problem in ventilation whose difficulty was increased because the machines had to carry full loads during even the hottest summer days. After some study, a volute blower housing was devised with which each motor and generator was circumferentially and separately inclosed. These, in effect, made blowers out of each unit, inasmuch as large intakes to the open air were provided, and the machines, so inclosed, drew sufficient quantities of cooling air into their windings through each end of their housings to keep well under safe operating temperatures.

The hot air is exhausted into pits beneath each m.g. set and led from these in ducts beneath the mill floor proper to vents located alongside the supporting roof columns, where it is discharged into the main mill working areas. This method of cooling has proved so effective in dissipating the heat that even when carrying a full load on the hottest summer days the motor-generator housings scarcely feel warm to the hand.

Operating Sequence Obtained Automatically by Modified Control

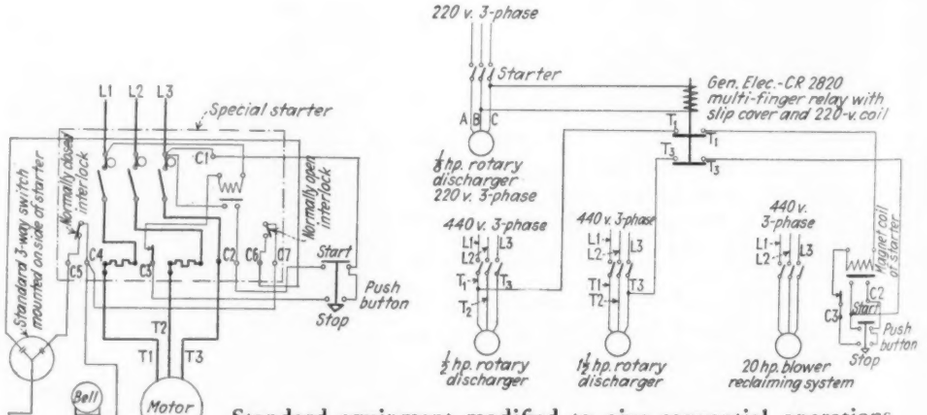
By EUSTACE C. SOARES
The R. B. Engineering Company, New York, N. Y.

Where certain motor-driven equipment must be started in a definite sequence standard control equipment may be used and connected to provide a fool-proof automatic control. The accompanying diagram illustrates the method employed for handling grain in a brewery. It is important in this case that the blower which delivers the grain to the other equipment should not run before the other equipment is operating, otherwise the blower may feed grain to the discharger and choke it.

By using a General Electric CR-2820 multi-finger relay, or other similar relay, the closing coil of the 20-hp. blower, which must be the last equipment started, is so connected that all three motors must be operating before the blower can be started. The sequence operation of the three other motors is of no importance in this instance.

The connections T-1 and T-3 to the relay should be taken ahead of the thermal relays of the rotary discharger starters so as not to introduce the controller coil current through the relay. The internal connections of the starter for the 20-hp. blower must be rearranged as shown. The rearranging process is simple and is very readily accomplished.

Push buttons are grouped together on a panel with appropriate nameplates. Should the push button for the 20-hp. blower be operated out of sequence the blower



Standard equipment modified to give sequential operations

The connections T-1 and T-3 to the relay should be taken ahead of the thermal relays of the rotary discharger starters so as not to introduce the controller coil current through the relay. The internal connections of the starter for the 20-hp. blower must be rearranged as shown. The rearranging process is simple and is very readily accomplished.

IN BRIEF · · ·

will not start in any event, so that it is impossible to start the 20-hp. blower before the other three motors are in operation.

The same method of control may be applied to any equipment where one group of motors must be started before another group. By using additional relays the sequence starting could be extended to include more than one step in the sequence. For instance, in the accompanying diagram all four motors could be arranged so that they could only be started in a definite order by interposing a relay between each unit and slightly changing the starter connections.

As shown in the diagram changes have been made in the controller magnet coil circuit. Incidentally, the controller contains two small interlocks, one normally open and one normally closed. These interlocks are combined to operate as a three-way switch, which in conjunction with another three-way switch mounted on the side of the controller provides an automatic fool-proof alarm system should the controller open for any reason.

Determining Substation Capacity to Supply Mine Locomotives

By R. J. CORFIELD
Assistant Electrical Engineer
Utah Copper Company, Garfield, Utah

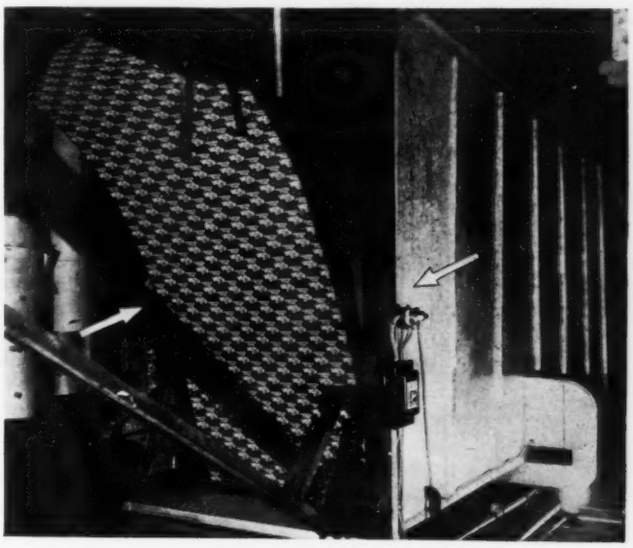
Several methods were used in arriving at the substation capacity requirements to supply forty 75-ton electric locomotives in electrifying the Bingham mines of the Utah Copper Company. Approximately 60 miles of No. 4/0 trolley was to be supplied at 750 volts d.c. The calculated input to a twelve-car train of empties (265 tons trailing) ascending a 4 per cent grade is approximately 825 kw. The maximum assumption would be twenty locomotives going up grade simultaneously, thus giving a load of approximately 16,000 kw.

The part that diversity plays in setting load demands was also considered. Theoretical diversity curves were plotted based on various assumed conditions. The theory of probability was used in trying to determine possible coincident peaks and, as a further check, each locomotive was given four current ratings representing four load conditions, such as going up grade, level running empty, level running loaded and spotting cars at the shovel. Cardboards (160 of them) were properly marked and placed in a box and then 40 of the cards were drawn at random.

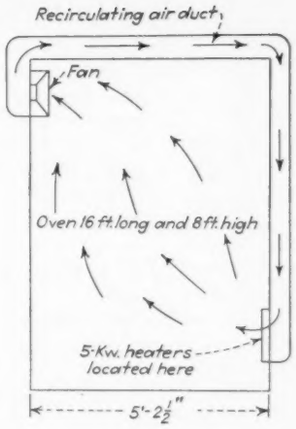
These random drawings were all tabulated and compared with the calculated values, a composite of these values serving as an index to the required initial capacity. The electrification was done somewhat on the installment plan, so that sufficient time was allowed between installations to determine actual peaks, averages and diversity and theory and practice checked to give the final installation. The final decision was to install two automatic substations of the semi-outdoor type, each containing four 1,000-kw., 750-volt, 900-r.p.m. shunt-wound synchronous converters. One unit at each station is a manually operated master, the others are cut in as needed by thermal relays on loaded machines.

Electric Heat Expedites Trunk-Liner Drying

The drying of figured trunk-lining paper has been very much expedited by a St. Louis, Mo., concern through the installation of 5 kw. of electric strip heaters as a "booster" heat source. Located at the outlet of a forced-draft duct near the bottom of one side of the drying oven, these elements produce an additional temperature rise of between 20 and 25 deg. F., sufficient to make it possible to maintain a speed of approximately 400 ft. per minute for the rolls of paper passing through the drier.



Arrows indicate location of the 5 kw. in strip heaters and the control switch in this drying oven



Duct system recirculates air throughout the drier for trunk-lining paper

A forced-draft fan, located at the inlet to the duct system at the top and opposite side of the oven, serves to draw the warmed air rapidly across the surface of the moving paper; at the same time it carries the cooled air through the duct and back to cross the group of strip heaters at the outlet of the duct where the "boost" to the temperature is given as the recirculated air again enters the drying chamber.

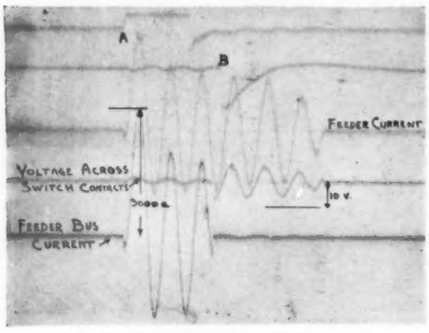
LETTERS TO THE EDITOR

Fault Transfer Switch Has Merits

To the Editor of the ELECTRICAL WORLD:

A letter by C. H. Sanderson to ELECTRICAL WORLD published on May 5, 1934, page 664, in criticism of the fault transfer switch ("Transfer Feeder Faults to One Breaker," ELECTRICAL WORLD, March 31, 1934, page 464) contains some statements which indicate that the scheme requires further explanation.

Regarding paragraph 3 of the letter, a careful search of the technical literature and patent files has disclosed no prior description of a practical system



Added time delay only 2½ cycles

This oscillogram was taken on a test of a rough model where no special effort was made to obtain fast operation and shows a time delay, from A, where voltage is applied to the trip coil of the transfer switch, to B, where voltage is applied to the trip coil of the circuit breaker, of approximately 2½ cycles, which would add 21 per cent rather than 200 per cent to the operating time of a 12-cycle breaker. The peak voltage across the contacts is only 6.1 volts, with a peak current of 3,000 amp. This voltage would be the same for a circuit voltage of 13.2 kv. as for 2,300 volts.

of the type described. The first concrete criticism is in paragraphs 4 and 5, to the effect that approximately 0.40 second, or 24 cycles delay (60-cycle system), will be added by the transfer switch to the time of fault clearance in addition to the 12 cycles required by the usual present standard equipment—a 200 per cent increase. No such delay in operation is contemplated.

In general, the time of operation of the transfer switch will be less than that of a corresponding circuit breaker, because with absence of arcing smaller distances of contact travel may be used (see accompanying oscillogram).

The estimate of additional bus extension, ranging up to 1,000 per cent or more (paragraph 6), must be the result of some misunderstanding. The only additional bus necessary is a breaker bus which parallels the main bus or feeder bus, whichever would ordinarily supply the feeders.

In paragraph 8 the statement is made that "Experience with the installation, maintenance and safety considerations of air-insulated automatic protection equipment for important high-voltage, heavy-duty applications has practically vetoed its use." The only interpretation of this is as a reference to air circuit breakers. It needs to be kept clearly in mind that the fault transfer switch *does not break any circuit until it is in series with an open oil breaker.* Protection to personnel may be given by the same degree of inclosing that is given to disconnect switches.

Regarding the matter of cost, one of the chief advantages of the fault transfer switch is that its cost will not increase as rapidly with increase of voltages as will that of any ordinary type of circuit breaker. The voltage which appears across the contacts when transfer to the feeder bus is made is only the drop in the bus loop, and is a function of the current only, and not of the circuit voltage. The circuit voltage does not appear across the switch until after the circuit breaker has opened.

It is not uncommon to look at new developments from the narrow viewpoint of using them in combination with absolutely standard present devices, whereas actually they usually cause modifications to be made in the design of associated equipment. For example, if ten expensive circuit breakers are replaced by ten inexpensive fault transfer switches and one circuit breaker it will become economical to spend part of the savings for a better and faster breaker.

L. F. WOODRUFF, J. E. MULLIGAN.
Massachusetts Institute of Technology, Cambridge, Mass.

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Not a Paradox in Lighting

To the Editor of the ELECTRICAL WORLD:

My attention has been called to an article by I. J. Sattinger in the March 3 issue of the ELECTRICAL WORLD, page 334, entitled "Mixed-Color Lights Show Intensity Paradox."

This is not a paradox at all. Heterochromatic photometry can be done accurately only in a few laboratories in the entire world. Mr. Sattinger, by means of results which he admits to be "only roughly approximate," cannot disprove the results of highly accurate heterochromatic photometry. What he has proved is that his results are "only roughly approximate" because they indicate a paradox which does not actually exist. If his results were accurate, as they would be in a few laboratories equipped to do heterochromatic photometry with high accuracy, he would have proved what is widely accepted; that is, that luminous sensations are strictly additive regardless of color.

M. LUCKIESH,
Director.
General Electric Lighting Research Laboratory, Nela Park, Cleveland.

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Installment Sales in Berlin

To the Editor of the ELECTRICAL WORLD:

In your issue of June 9 I find a paper read by Vice-President Quinn of the General Electric Company at the E.E.I. convention. You may be interested to know that I introduced a system very similar to that which Mr. Quinn proposes as early as 1927 in the B.E.W.A.G. of Berlin, of which company I was a managing director until the Hitler revolution. This system was called the Electrissima (or E^3) system and worked like this:

We had all qualified retailers and jobbers of Berlin (including the department stores and the retailing departments of the big firms like Siemens and A.E.G.) sell electrical apparatus and electrical installations on the installment sales plan. We bought these contracts from them at cash price and booked, billed and collected the installments from the customers, adding the necessary percentage (fixed in advance in the original contract and amounting generally to 10 per cent) for interest, risk and collecting expenses, together with the bills for current sales.

This system has functioned very satisfactorily even during the years of depression; it has helped enormously to bring the electrification of Berlin homes from 30 to 80 per cent and it did more than almost all other measures of B.E.W.A.G. to build very agreeable public relations. In fact, the sign of the system ("E^3" in green and gold) which was affixed to every dealer's shop, was vastly popular with the whole population. The losses have always kept sensibly below 1 per cent.

This latter fact was due to the introduction at the same time of a new method of credit inquiries. We united the bulk of all other firms selling on the installment plan or on credit generally in an organization for mutual confidential information. In order to make quick work and to keep the costs down, the points on which information was asked and given were limited to a certain number of essential facts. By this method it was made possible that the members of the organization could inquire over the telephone in every case, and this at a fee of about 25 pfennig an inquiry. After a very short time this organization, called "Schufa," covered practically the whole population of Berlin and its suburbs. The "E^3" system has been copied more or less by quite a lot of companies in and outside Germany.

ROBERT KAUFFMANN.
Paris, France.

NEWS OF THE WEEK

T.V.A. Raises Offer by $800,000; Completes Knoxville Purchase

Agreement reached with Tennessee Public Service Company calls for sale price of $6,088,000. Thirteen Alabama towns in deal to purchase distribution systems and T.V.A. power. Alabama Commission claims authority over T.V.A.

THREE major developments characterized the action on the T.V.A. front this week. Retreating from its month-old take-it-or-leave-it final offer of $6,550,000 to the Tennessee Public Service Company for its Knoxville properties, including the Watertown-Kingsport transmission line, the Tennessee Valley Authority this week completed the deal with the utility by raising its offer to $6,088,000 and excluding the purchase of the transmission line, which will be sold to American Gas & Electric Company for $1,292,000. Acceptance by all the towns in northern Alabama of T.V.A.'s offer to sell local distribution lines and facilities purchased by T.V.A. from Alabama Power Company, with T.V.A. to be reimbursed from profits of local power business, marked the second development of the week. In the third phase of the action the Alabama Public Service Commission ruled that the Tennessee Valley Authority in its distribution of electric power is subject to the same rules and regulations as any other public utility, thus asserting its power to take jurisdiction over T.V.A. in so far as rates and services in that state are concerned.

Long negotiations reach end

Following the passing of the deadline set in T.V.A.'s final offer to buy the Knoxville properties (ELECTRICAL WORLD, June 16, page 886) without acceptance by the utility of the authority's offer, a month of prolonged negotiations resulted in the agreement reached this week. The agreement is contingent, said David E. Lilienthal, in announcing the consummation of the deal, upon the bondholders turning in their bonds at a price of 96½, the issuing price, within three weeks. If by August 8 the company has not been able to get the bonds in at that price the deal is off and Knoxville will then proceed to open bids to build its own facilities.

Tennessee Public Service Company has outstanding $7,000,000 of 5 per cent first and refunding mortgage bonds, offered publicly in September, 1930, at 96½. The bonds are due October 1, 1970, and are callable in whole or in part on 30 days notice at 105 up to and including October 1, 1935, and at a lower price at later dates. The purchase agreement with T.V.A. does not include the Knoxville traction properties of the company, for which $780,000 in bonds are outstanding.

Bonds more than covered

With a price of $6,088,000, plus cash of approximately $1,700,000 and $1,292,000 realized from the sale of the transmission line, there is available $9,080,000 to pay off the bonds, leaving approximately $1,545,000 available for the preferred- and common-stock holders, who will also have the traction facilities. The capital stock of the company is carried in the balance sheet at $10,000,000, which includes 50,000 shares of $6 preferred and 1,000,000 shares of common stock. At the office of the Tennessee utility's parent, the National Power & Light Company, in New York, C. E. Groesbeck stated that "while the negotiations naturally brought out sharply divergent views between the representatives of the company and representatives of the authority, I can say that these negotiations were conducted on the highest plane in an attempt to work out some compromise between these views so that ruinous competition might be avoided."

The sale includes all Tennessee Public Service Company's electric distribution and transmission lines except the line between Waterville and Kingsport. At first the authority will operate the entire system, supplying Knoxville and 27 other communities with Muscle Shoals power. During that time it will add a 10 per cent surcharge to the standard T.V.A. rates, which will go toward paying for the distribution systems. Thus, Knoxville and the other municipalities will acquire distribution systems without the outlay of one cent.

Alabama towns in T.V.A. deal

The thirteen Alabama towns soon to be served with T.V.A. power are Courtland, Decatur, Falkville, Hartselle, Moulton, Red Bay, Russellville, Town Creek, Cherokee, Leighton, Tuscumbia, Sheffield and Florence. Under their arrangements with the authority T.V.A. will sell the distribution systems purchased from Alabama Power Company to the individual municipalities, accepting payment from profits made by the municipalities on the sale of T.V.A. power. Adding to the standard T.V.A. rate a developmental surcharge of 10 per cent to all rate classifications, T.V.A. estimates that the towns can pay off in ten years, without issuing bonds or other credit obligations beyond the promise to pay from system profits. No profit will be made by T.V.A. in transferring the properties bought to the communities, the price to the towns being the same as that paid to the Alabama Power Company.

David E. Lilienthal, in response to a telephone request from ELECTRICAL WORLD, was unwilling to comment on the order of the Alabama Public Service Commission requiring T.V.A. to file its schedules of rates with the commission and otherwise adhere to commission rulings on all T.V.A. Alabama business. Informed quarters, however, indicate that the legality of the order will be decided in the courts, as T.V.A. is believed to take the stand that the order will not hold against a strictly federal organization.

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A. F. of L. Unions Selected to Bargain in Milwaukee

Under the terms of the agreement which terminated the recent strike (ELECTRICAL WORLD, July 7, page 24), the national labor board tribunal has named three American Federation of Labor unions as sole representatives for collective bargaining in three crafts of the Milwaukee Electric Railway & Light Company. The Amalgamated Association of Street Electric Railway and Motor Coach Employees of America shall represent the trainmen and busmen, the International Brotherhood of Electrical Workers shall represent the electrical workers and the International Union of Operating Engineers shall represent the power house workers.

While officials did not report how the membership of the three craft unions compared with the total employees in these departments, union representatives claim more than 95 per cent of the employees in the street car and bus division and a more moderate majority among the electricians and power house employees. These three crafts represent approximately 2,200 employees, or nearly half of the total employees of the utility.

Roosevelt Appoints New Power Committee

National policy to be formulated with cheaper rates the objective—State rights preserved—Ickes named chairman.

With the purpose of developing a national plan for closer co-operation among public and private power interests, President Roosevelt has established in the Public Works Administration a National Power Policy Committee to make a thorough study of the whole problem. In a letter to Secretary Ickes of the Interior Department, who will serve as chairman, the President called attention to the fact that several agencies of the government have surveys in process, and specified as the duty of the committee the formulation of a national power policy.

Those who will serve on the committee with Secretary Ickes include: Dr. Elwood Mead of the Bureau of Reclamation; Frank R. McNinch, chairman of the Federal Power Commission; Morris L. Cooke of the Mississippi Valley Committee, P.W.A.; Major-Gen. Edward M. Markham, chief of engineers, War Department; Robert E. Healy of the Federal Stock Exchange Commission; David E. Lilienthal of the Tennessee Valley Authority and T. W. Norcross, assistant forester of the Forest Service.

"I wish to establish in the Public Works Administration a committee to be called the 'National Power Policy Committee,'" the President said in his letter to Secretary Ickes. "Its duty will be to develop a plan for the closer co-operation of the several factors in our electrical power supply—both public and private—whereby national policy in power matters may be unified and electricity be made more broadly available at cheaper rates to industry, to domestic and particularly to agricultural consumers.

"Several agencies of the government, such as the Federal Power and Trade Commissions, have in process surveys and reports useful in this connection. The Mississippi Valley Committee of Public Works is making studies of the feasibility of power in connection with water storage, flood control and navigation projects. The War Department and Bureau of Reclamation have under construction great hydro-electric plants. Representatives of these agencies have been asked to serve on the committee. It is not to be merely a fact-finding body, but rather one for the development and unification of national power policy.

"As time goes on there undoubtedly will be legislation on the subject of holding companies and for the regulation of electric current in interstate commerce. This committee should consider what lines should be followed in shaping up this legislation.

"Since a number of the states have commissions having jurisdiction over intrastate power matters, it is necessary that whatever plan is developed should have regard to the powers of these various state commissions as well as of the states in general."

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COMING MEETINGS

Economic Conference of Engineers—Fourth annual meeting, Stevens Institute of Technology Engineering Camp, Johnsonburg, N. J., August 11-19. Harvey N. Davis, Stevens Institute of Technology, Hoboken, N. J.

International Association of Municipal Electricians — Wardman Park Hotel, Washington, D. C., August 29-Sept. 1. W. H. Harth, City Hall, Columbia, S. C.

Producers and Distributors of Electrical Energy—Fifth International Congress, Zurich and Lausanne, Switzerland, August 29-Sept. 7. Secretary, Union des Centrales Suisses d'Electricite, 301 Seefeldstrasse, Zurich.

American Institute of Electrical Engineers—Pacific Coast Convention, Salt Lake City, Utah, September 3-7. General Convention Committee, 1016 Continental Bank Bldg., Salt Lake City, Utah.

Association of Iron and Steel Electrical Engineers—30th convention, held in conjunction with the Iron and Steel Exposition, Cleveland, Ohio, September 18-20. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

National Electrical Exposition — Madison Square Garden, New York, N. Y., September 19-29. Ralph Neumuller, Electrical Association of New York, Grand Central Palace, New York.

Electrochemical Society — Sixty-sixth convention, Hotel Pennsylvania, New York City, September 27-29. Colin G. Fink, Columbia University, New York.

Illuminating Engineering Society— Annual convention, Baltimore, Md., October 1-4. D. W. Atwater, Secretary, 29 West 39th Street, New York.

P.W.A. Allots $36,000,000 for Two Federal Projects

A total of $36,000,000 in "second year" allotments was granted this week by the Public Works Administration to carry on work on the Fort Peck Dam and reservoir in eastern Montana and to complete the large power, navigation and flood control project on the Columbia River at Bonneville, Ore. The Fort Peck allotment of $25,000,000 brings the total to $50,000,000 allocated by P.W.A. for the project. The $11,000,000 allotted to the Bonneville project follows an original disbursement of $20,000,000 and is estimated to be sufficient to bring the project to completion. According to present plans, the dam and six units of the power house will be built, with additional power units to be added as demand warrants.

Grand Coulee Dam, on the Columbia River, Washington, will be built by the Silas Mason Company of New York City, the Atkinson Kier Company of San Francisco and the Walsh Construction Company of Davenport, Iowa, whose joint bid of $29,339,301 received the Department of the Interior's award for construction of the project. The dam will be 335 ft. high and 3,400 ft. long and the initial power installation will comprise three 140,000-hp. units. Penstocks for additional units will be placed in the dam and plugged to await projected increase of the height to 1,500 ft.

. . . THIS WEEK IN WASHINGTON

No conflict between Power Policy Committee and Federal Power Commission, Ickes asserts . . . Municipal plant survey shows 2,390 communities with population of 9,596,753 have city-plant service.

ORGANIZATION of the Power Policy Committee was approved by the Federal Power Commission, Secretary Ickes, chairman, stated in reply to the question whether the committee's investigation would not overlap the survey of rates which has been undertaken by the commission. With reference to the reports that the committee will be used to build up sentiment for the St. Lawrence project, Secretary Ickes remarked that the committee is not concerned with any particular locality or project.

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A survey of municipally owned electric utilities by the Mississippi Valley Committee of P.W.A. reveals that 2,390 places, with a total population of 9,596,753, have municipal service. Population of places in which municipal plants supply street lighting only is 5,060,681. Places having steam plants number 482 and have kilowatt capacity of 1,181,376. Places having oil or gas engine generating plants number 512, with kilowatt capacity of 238,509. Places having hydro-generating plants number 148 with kilowatt capacity of 52,304. The number of places having generating plants totals 1,665 and total kilowatt capacity is 1,947,189. The number of communities purchasing all electrical energy used is 725. Meters in service for places in which data are available total 2,000,634.

This compilation lists only places for which authentic information is available. Places having municipal plants that may not be legally authorized to distribute energy to local consumers but permitted to service street lights or municipal buildings or water works are omitted. Population of the 22 places for which P.W.A. municipal systems have been approved is 278,185. Two of these places have steam plants with total capacity of 8,000 kw. Five have Diesel engine plants with 4,330 kw. capacity and four have hydro plants with 87,500 kw. capacity.

PAUL WOOTON,
Washington Correspondent.

Commission to Probe Abitibi Power Deal

Independently of the Federal Royal Commission already named, a commission appointed by the Ontario government has commenced an investigation into the circumstances surrounding the acquisition of the Abitibi Power properties in northern Ontario by the Ontario government a year and a half ago. The "Abitibi deal," as it was called, played a prominent part in the recent Ontario election campaign, and the charges leveled by the new Ontario Premier, Mitchell Hepburn, and his associates led Arthur Meighen, former Hydro commissioner, to seek an investigation to clear up allegations against his conduct as a member of the commission. That request was complied with recently when the federal government appointed a one-man commission.

The commission is authorized to inquire into the purchase of bonds of the Ontario Power Service Corporation, former owners of the Abitibi project, by the government of Ontario and by the Hydro Commission, and the payment therefor in bonds of the Ontario Hydro-Electric Power Commission. Further, the probe will extend to all transactions and dealings in the securities of the Ontario Power Service Corporation, the Abitibi Power & Paper Company and all other corporations dealing in power in Canada which have or had dealings with Hydro, or with the Ontario government by any member of the Ontario government or any former member of the Hydro Commission.

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Kentucky Commission Named

Appointments to the Kentucky Public Service Commission recently created by the state Legislature (ELECTRICAL WORLD, April 14, page 561) were announced last week by Gov. Ruby Laffoon. Appointees include Wilbur K. Miller, a lawyer, of Owensboro, Ky., designated as chairman; William D. Cochran, a lawyer, of Maysville, Ky., and Lloyd Clark of Cave City, Ky. The secretary of the commission will be Louis Cox, now tipstaff of the Kentucky Court of Appeals. As commission counsel, the Attorney-General has designated Assistant Attorney-General Francis M. Burke.

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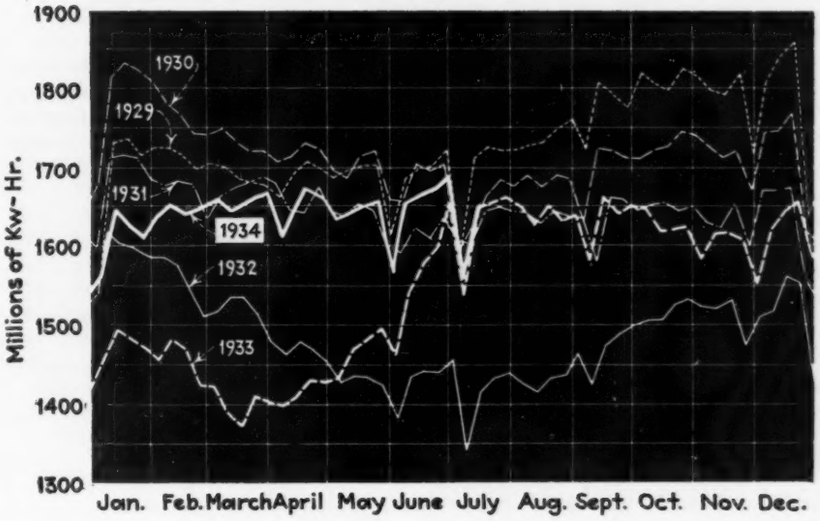
British Output Rises 17%

For the first six months of 1934 the total amount of electricity generated by authorized undertakers in Great Britain was 7,630,000,000 kw.-hr., an increase of 17 per cent over the first six months of 1933, the British Electricity Commission reports.

Output Matches Last Year's



Output of electrical energy by central stations during the week ended July 14, rising from the sag due to the holiday, was almost identical with that of the corresponding week a year ago. According to the Edison Electric Institute it amounted to 1,647,680,000 kw.-hr., or 2.4 per cent less than during the last week in June. The decrease is a normal one, close to the average for the preceding five years, but summer figures generally higher than those of the preceding winter continue to present an unusual feature.

As to the regional figures, the decrease of 9.8 per cent from 1933 in New England must be viewed in the light of a 26 per cent rise in 1933 over 1932. The South is again down 4.2 per cent, but with last year's rise of 25.8 per cent there remains a wide margin over 1932. The Pacific Coast continues its lead over 1933 of 10 per cent or more for the fourth time running, but the Middle Atlantic region fell to 2.7 per cent. Other regions are around last year's level.

Weekly Output, Millions of Kw.-Hr.

1934		1933		1932	
July 14	1,648	July 15	1,648	July 16	1,416
July 7	1,556	July 8	1,539	July 9	1,342
June 30	1,688	July 1	1,656	July 2	1,457
June 23	1,675	June 24	1,598	June 25	1,441
June 16	1,665	June 17	1,578	June 18	1,442

Per Cent Change from Previous Year

Region	Week ended July 14	July 7	June 30
New England	— 9.8	—11.3	— 6.7
Middle Atlantic	+ 2.7	+ 5.8	+ 2.7
Central Industrial	— 1.0	— 0.3	+ 2.6
West Central	+ 0.7	+ 1.6	+ 5.3
Southern States	— 4.2	— 4.2	+ 1.9
Rocky Mountain	+ 0.2	+ 1.7	+ 1.5
Pacific Coast	+10.5	+11.9	+11.1
1 States	— 0.0	+ 1.1	+ 2.0

New River Project to Proceed Unlicensed

Notwithstanding its adverse experience in court involving the necessity of a federal license for the project, the Appalachian Electric Power Company has announced its intention to resume work almost immediately on its huge hydro-electric development on the New River in Pulaski County, Virginia, at a cost of approximately $11,000,000. Operations, without the required license, will be begun within the next week or ten days, the Virginia State Corporation Commission, which has issued a Virginia license, was formally notified by Graham Clayton, vice-president of the company.

The utility had previously notified the Federal Power Commission of its intention to proceed with the project (ELECTRICAL WORLD, June 30, page 958), and although that body declined to make a formal statement it is likely that an injunction will be sought similar to that obtained recently against the Union Carbide Company and its subsidiary, the Electro-Metallurgical Company, restraining them from construction of a plant on the New River in West Virginia (ELECTRICAL WORLD, June 23, page 923).

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Louisiana to Tax Utilities 2% on Gross Receipts

Along with its current Senator Huey P. "Kingfish" Long-backed program of taxation on opposition newspapers, the Louisiana Legislature last week passed a bill creating a tax of 2 per cent on the gross receipts of public utilities in the state. The measures are now before the Governor for signature.

As to Rates . . .

• Commonwealth Edison Company's electric rate case has been continued by the Illinois Commerce Commission until July 25 to give the company more time in which to prepare certain data requested by the commission.

• Georgia Power & Light Company has petitioned the court for an order enjoining the state Public Service Commission from putting into effect the rate cut ordered effective August 1 (ELECTRICAL WORLD, July 14, page 62). The case has been set for hearing on July 25.

• Southwestern Gas & Electric Company has reduced by 10 per cent electric rate charges to residential and commercial consumers in approximately 50 cities.

• New York Public Service Commission has denied applications of several utility companies asking for the rescinding of the orders directing that the costs of rate proceedings be assessed against the companies as the commission was authorized to do by a law enacted at the last regular session of the Legislature. The companies asked that the orders assessing the costs be "abrogated, rescinded and annulled, as unauthorized by and contrary to law," and also asked that if this relief be not granted a rehearing be held on the orders. In some cases only rehearings were asked for and in each case they were also denied. The companies making the application were the Kings County Lighting, Yonkers Electric Light & Power, Bronx Gas & Electric, Rockland Light & Power and South Bay Consolidated Water.

• Missouri Electric Power Company has been ordered by the state Public Service Commission to readjust its rates in nine southern and southeastern towns. The commission's decision set the fair return upon a fair value of the company's properties at 6½ per cent a year for Sullivan, Cabool, Ava, Willow Springs, Marshfield, Seymour, Fordland, Niangua and Winona. The commission's ruling was interpreted as setting a precedent in that it ruled that the company could not include in its rate-basing valuation the hydro-electric dam project at Lebanon on the Niangua River, valued at $1,100,000. The commission brought out the fact that the company has a contract with the Empire District Electric Company calling for purchase of a minimum of $40,000 of electricity annually, and under this contract the company can purchase power at a lower rate than it can be produced at the Niangua plant. "In determining the fair value of the property used and useful in public service," the decision said, "property in excess of the reasonable future requirements of the territory or property which has been imprudently constructed should be eliminated from the rate base. We are aware of the danger of discouraging the initiative of utility operators by being unduly strict in excluding from the rate base investments in property made in good faith and in reasonable anticipation of future needs. However, if a property which cannot earn its fixed charges is injected into a rate base and the consumer is required to pay rates to earn a return upon such property, then it becomes our duty to consider whether the construction was justified. . . . It seems quite conclusive to us that the management was not justified in the construction of this plant when considered in the light of the comparative cost of producing electricity with the cost of purchase under the contract with the Empire company."

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Cincinnati Consumers Get $9,000,000 Rate Cut

Electric light and power customers in Cincinnati will receive a substantial reduction in rates as a result of an ordinance passed last week by the City Council and agreed to by the Union Gas & Electric Company, subsidiary of Columbia Gas & Electric Corporation. The new schedule calls for a $9,000,000 reduction over a four-year period, in addition to a refund of approximately $1,200,000 on bills charged since last November. While residental consumers are particularly benefited by the rate cut, small commercial and power users will also realize substantial savings.

Eliminating the present 10 cents a room demand charge, the new schedule for the first year calls for a rate of 5 cents a kilowatt-hour a room a month for not less than 20 kw.-hr. in the first step. The rate then drops to 3 cents a kilowatt-hour for the second 5 kw.-hr. a room a month of less than 20 kw.-hr. All additional consumption is at the rate of 2 cents a kilowatt-hour. From August 10, 1935, for one year, the rate drops from 5 cents a kilowatt-hour in the first step to 4½ cents, with the 3-cent and 2-cent steps remaining the same. Beginning August 10, 1936, and running for a year the rate drops to 4 cents in the first step, the second block remains the same, but in the third block the rate is 1.8 cents. Beginning August 10, 1937, the only change in the schedule is that in the third block, where the rate is decreased to 1.5 cents a kilowatt-hour instead of 1.8 cents. The minimum bill is 60 cents a month.

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No Action on Camden Loan

Efforts of Senator Woodruff of Camden County before the New Jersey Legislature adjourned to obtain passage of bills enabling the city of Camden to borrow $6,000,000 from the federal government for construction of a municipal light plant failed. The measures were suggested by Public Works Administrator Harold L. Ickes (ELECTRICAL WORLD, July 14, page 62). The Senators who blocked the bills maintained that they "might lift the lid off all municipal debt limits."

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Sioux City to Vote on City Plant

On July 30 a special election will be held in Sioux City, Iowa, on a proposal that the city construct, maintain and operate a municipal light and power plant estimated to cost $3,612,500. It is proposed to amortize the cost over a period of twenty years at 5 per cent interest. The city is planning to issue $2,500,000 bonds to help finance the project and to finance the balance through a P.W.A. grant.

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Special Election Called in Moberly, Mo.

Having been informed that unless an election was held not later than the last week in July the P.W.A. grant and loan to the city would be withdrawn, the City Council of Moberly, Mo., has called a special election for July 24 on a $566,000 bond issue for a municipal light and power plant. It had been planned to hold the election in September. The loan and grant amount to $700,000.

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Plant Bonds Disapproved

By a vote of four to one Mound City (Mo.) has vetoed the issuance of $75,000 of bonds to finance the construction of a municipal light plant. The Missouri Service Company supplies the city with electricity.

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Cushing, Okla., Project Again in Court

The city of Cushing, Okla., has been temporarily restrained from delivering to the United States Government the bonds voted recently for the construction of a municipal electric plant in that city. The Interstate Power Company secured the restraining order in the case, alleging fraud in the bond election. Judge Arthur G. Sutton of Alva, special judge assigned to the case after Judge Freeman Miller had been ordered by the Supreme Court to disqualify himself, ordered the petitioners to amplify the fraud charges and set the date for trial of the case for September 4.

FINANCIAL · · · BUSINESS

Agreement Reached on Middle West Plan

Program calls for stock issue of 3,000,000 shares—Creditor bank claims to be settled at 52 cents on the dollar.

Creditors and security holders of the Middle West Utilities Company have come to an agreement on a plan for reorganizing the holding company, which they presented to Federal Judge James H. Wilkerson this week. The program calls for a total issue of 3,000,000 shares of a single class of common stock, with 1,695,000 shares going to the bankers in full settlement of their secured claims. The banking creditors, however, agree to give the noteholders' committee an option to take over the latter shares at $6 a share, or an aggregate of $10,170,000. This means that the bankers will take 52 cents on the dollar on the face value of their claims. The division of stock between secured and unsecured creditors is figured at 63.7 and 36.3 per cent, respectively.

Both common and preferred stockholders are to keep an interest in the reorganized company whether or not they supply any of the additional $10,000,000 needed to buy out the secured creditors. In the event that the money is raised, both noteholders and stockholders subscribing will be treated exactly alike. They will receive a prior security for the money they put in, plus an allotment of prior stock. Non-subscribing stockholders will receive a subordinate class of stock.

Creditor banks are the Continental Illinois, First National of Chicago, Central Republic and the Bankers Trust Company. The Bankers Trust Company has the biggest claim, amounting to $10,250,000. Halsey, Stuart & Company, another secured creditor, has consistently refused to participate in a plan of the type proposed. What action would be taken by that group remained uncertain. The General Electric Company, the other secured creditor, is to receive 15,000 shares of stock, but did not join in giving other creditors the $6 purchase option, preferring to remain as a stockholder in the reorganized company. Granting of a petition for reorganization under the amended bankruptcy act was taken under advisement.

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Laclede Plan Operative

On July 23 the plan of the Laclede Gas Light Company for extending the refunding and extension mortgage 5 per cent bonds will become operative. E. P. Gosling, president, has announced that $21.60 a bond will be mailed to registered owners of certificates of deposit of that date. Certificates issued after July 23 will not carry that payment.

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Frisco Power Unimpaired

The San Francisco general strike, which commercially paralyzed that city and environs, failed to disturb electric light and power service. The Electrical Workers Union, Local 151, voted unanimously to defer a strike vote until July 26. Harry F. Brigaerts, vice-president of the International Brotherhood of Electrical Workers, explaining the decision, said: "The Electrical Workers Union is holding off until the last possible moment a vote on whether it is to participate in the general strike. The sentiment of our members is founded on their humanitarian principles and appreciation for the welfare of the general public."

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Two Competitive Bids Made for Long Island Bonds

At a hearing held this week before Chairman Milo R. Maltbie of the New York Public Service Commission on the proposed $6,845,500 bond issue of the Long Island Lighting Company (ELECTRICAL WORLD, June 30, page 962) two offers were made from the floor in competition with the contract of sale for which the company sought approval. The new bids, both higher than the offer accepted by the company but lower than the selling price of 97 per cent of par set by the commission, would require registration of the bond issue under the federal securities act.

Declaring the cost of registration would offset the higher prices offered, attorneys for the company defended the company's plan to sell the bonds without registration to the Metropolitan Life Insurance Company and the East River Savings Bank.

Mr. Cummings produced the first new offer, from a syndicate composed of Blyth & Company, Hemphill, Noyes & Company, W. C. Langley & Company, Hayden, Stone & Company and White, Weld & Company. This group offered to take $5,000,000 of the bonds at 93½ if they were registered within 60 days, with an option on the remainder for 90 days. Bernard Flexner, an attorney, who said he represented a responsible investment banking house seeking to bid, announced that if the issue were registered his client was willing to bid 93½ or better for $6,000,000 of the bonds. Later both of these offers were extended to $6,645,500 of the bonds. The offer of the Metropolitan Life and the East River Savings Bank was 93 for a minimum of $6,451,700 and a maximum of $6,645,500.

Chairman Maltbie reserved decision on the matter, which is an application by the company to sell at 93 instead of the figure of 97 set by the commission. An injunction action to prevent the company from carrying through the proposed contract of sale to the insurance company and the bank is pending in Supreme Court, with Chester Dale, a partner in W. C. Langley & Company, as one of the plaintiffs.

SHOWDOWN

With all indications pointing toward a more violent phase but an ultimate failure of the Pacific Coast's general strike, business sees in radicalism's failure hope for reinspiration of confidence and continuance of an orderly process of recovery.

Current telltales of business activity, having fully reflected the extent of the holiday decline, now show a degree of recovery better than many believed possible. Energy production for the week ended July 14 rose from its holiday slump to the level of the same 1933 week. Continued public buying, even at this late season, is reflected in the sharp stepping-up of automobile production to more than double that of the first July week. Once again steel notes a rise in rate of output. But most recent carloading figures, reflecting the holiday drop, show a decline of nearly 20 per cent from the previous week, and are now at a point 4.4 per cent under the same 1933 week. Bituminous coal production also was off sharply during the Independence Day week, falling to a point below the 1933 level. Security prices eased slightly during the week. Commodities, exhibiting mixed trends, showed gains in cotton and the grains and moderate losses in the metals.

Commission Cuts Costs

Determined to cut operation costs and general expenditures, the new Ontario Hydro-Electric Power Commission has dismissed F. A. Gaby, chief engineer. Along with him went I. B. Lucas, general solicitor for the commission, while 46 other commission employees receiving salaries in excess of $5,000 a year have been served with notice of dismissal with the option of remaining at their tasks at such salaries as the commission decides to pay them. Mr. Gaby has been with the commission since 1907.

General Electric Billings, Profits Rise in Six Months

Sales billed by General Electric Company during the first six months of 1934 amounted to $80,983,093.60, compared with $61,773,414.19 during the corresponding period last year, an increase of 31 per cent, President Gerard Swope announced this week. Profit available for common stock for the second quarter of 1934 was $4,253,595.86, equivalent to 15 cents per share, or substantially the same as the quarterly dividend of 15 cents a share to be paid on July 25 to approximately 192,000 stockholders, compared with 10 cents per share paid to 184,000 stockholders a year ago.

Profit available for common stock for the first six months of this year was $8,175,557.22, compared with $4,666,080.69 for the first six months of last year. This profit is equivalent to 28 cents per share for the first six months of 1934 and 16 cents a share for the first six months of 1933 on 28,845,927 shares outstanding in both periods.

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New England Company Prepares for New Financing

Statement has been filed by the Western Massachusetts Companies, Boston, with the Federal Trade Commission, requesting registration of $8,500,000 of coupon notes to be dated August 1, 1934. Interest rate and proposed price per unit at which the notes are to be offered to the public have not yet been ascertained. The operation is presumably a refinancing one, whereby funds are sought with which to meet $5,000,000 of 4½ per cent notes maturing September 15, 1934, to refund $2,500,000 of 5 per cent notes due October 15, 1937, and to supply $1,000,000 for the liquidation of short-term borrowings of subsidiary companies. The business of the constituent utility companies for the four months ended April 30 increased 7 per cent over the same period a year ago.

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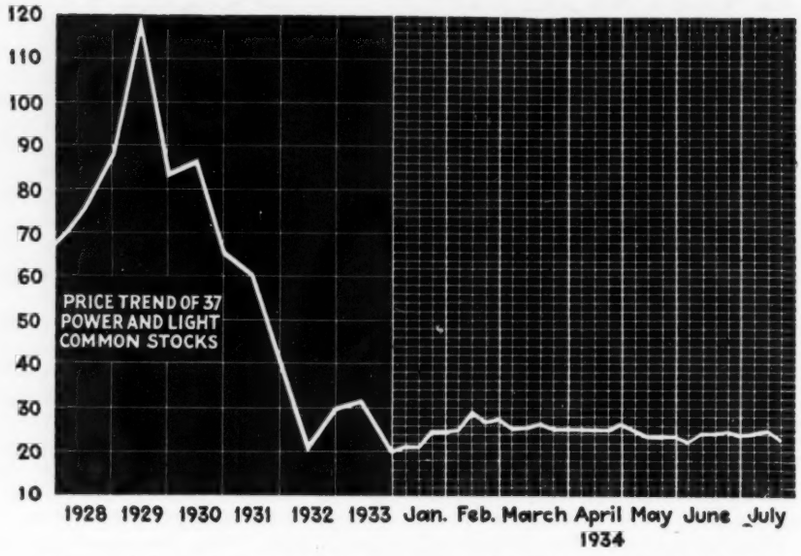
Superpower Sets Up Fund

In a special report to stockholders the American Superpower Corporation, as of June 30, states that "in order more nearly to reflect on its books the approximate market value of the corporation's holdings in common stocks and option warrants, a reserve of $65,000,000 on account of decrease in market value from the book cost of such securities has been created by transferring approximately $37,000,000 from capital surplus and the balance from earned surplus." Holdings of United States Government securities, corporate bonds, preferred and common stocks and option warrants had a market value of $39,978,505 on June 30, compared with $39,059,421 on December 31, 1933, for securities owned on that date.

Utility Stocks Decline



Electric light and power stocks lost ground this week, price changes being sufficient to carry the *Electrical World* index down to 22.9, from 24.5 last week

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Birmingham Electric Co. Votes Preferred Dividend

Within a month of its recent disbursement of accumulated dividends on its preferred stock, the Birmingham Electric Company last week declared a quarterly dividend of $1.50 on the $6 preferred and $1.75 on the $7 preferred stock. The dividend is payable August 1 to stockholders of record July 14.

•

Standard Gas Customers

Subsidiary and affiliated companies of the Standard Gas & Electric Company report an increase of 44,068 customers during the twelve months ended May 31, a gain of 2.80 per cent. This contrasts with a loss of 34,673 during 1932 and compares with a gain of 12,728 in 1933.

•

Westinghouse Gets Order for Battleship Generators

To modernize the electrical facilities of four battleships now being reconditioned, the Westinghouse Electric & Manufacturing Company has received an order, amounting to approximately $145,000, for sixteen 400-kw. generators and spares. The equipment will provide lighting and power on the *U.S.S. Texas, New York, Nevada* and *Oklahoma*. Westinghouse was awarded the contract by the Moore Steam Turbine Corporation of Wellsville, N. Y., which will furnish the turbines and reduction gears for driving these generators.

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Notes Called for Payment

Eastern Utilities Associates has called for redemption on August 1 at 100½ and interest its $2,400,000 of three-year 5 per cent gold notes due October 15, 1935. This is the company's only funded debt. The company has made arrangements with banks in Boston for a two-year loan on terms more favorable than those of the note issue and has reserved the right to undertake a refunding operation if conditions in the bond market are propitious, prior to the maturity of the bank loan.

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Delta Manufacturing Joins Raytheon Company

Consolidation of the Delta Manufacturing Company, formerly of Cambridge, Mass., with the Raytheon Manufacturing Company has been announced. The activities of the combined companies will be carried on under the name of Raytheon Manufacturing Company, electrical equipment division, in a recently acquired plant in Waltham, Mass. The Delta company makes Acme-Delta transformers, chokes and power equipment for radio amateurs, high-voltage

rectifiers for broadcast stations, voltage regulators and other special power conversion equipment.

•

Allis-Chalmers Orders Rise

An increase of 96 per cent over the same period of 1933 was attained by the Allis-Chalmers Manufacturing Company in orders booked during the quarter ended June 30, the company reports. Orders for the quarter totaled $5,982,212, compared with $3,047,223 for the same quarter of 1933. For the first six months of 1934 orders amounted to $10,579,868, compared with $4,767,789 in the first half of 1933, a gain of 122 per cent.

•

Cutler-Hammer Sales Up in Second Quarter

Shipments of Cutler-Hammer, Inc., in the second quarter of 1934 totaled $1,497,000, as compared with $1,175,000 for the first quarter of the year. For the first six months shipments almost doubled the $1,436,000 for the corresponding period of 1933. Second quarter shipments in 1933 were only $850,324.

•

Electromaster Sales Jump 300 per Cent in 1934

Sales of electric ranges and water heaters by Electromaster, Inc., for the first half of 1934 were 300 per cent of sales for the corresponding period of 1933. R. B. Marshall president, stated that the second quarter of 1934 was the most profitable period in the company's history. Gross sales in 1934 have already exceeded the gross sales for the full year of 1933.

•

Birtman Has Dividend

Birtman Electric Company has declared a quarterly dividend of 10 cents on the common and the regular quarterly dividend of $1.75 on the preferred stock, both payable August 1 to holders of record July 16. Last common dividend was 20 cents, paid on December 1, 1933.

New York Metal Prices

	July 10, 1934 Cents per Pound	July 17, 1934 Cents per Pound
Copper, electrolytic	9.00*	9.00*
Lead, Am. S. & R. price	3.75	3.75
Antimony	7.75	8.20
Nickel ingot	35.00	35.00
Zinc, spot	4.70	4.65
Tin Straits	51.80	51.875
Aluminum, 99 per cent.	23.30	23.30

*Blue Eagle

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of the week. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

Pierre, S. D.—Asks bids until August 7 for equipment for city-owned electric light and power plant, including one Diesel engine-generator unit, exciter (or alternate on motor-generator set), switchboard and instruments, and complete accessories.

Pittsburgh, Pa.—O. Hommel Company, Inc., plans installation of motors and controls, conveyors, etc., in new metallic paint manufacturing plant. Cost over $70,000.

Cumberland, Md.—Plans new city-owned electric light and power plant. Estimated cost $1,523,000, including transmission lines. Burns & McDonnell Engineering Company, Kansas City, Mo., consulting engineer.

Los Angeles, Calif. — Water and Power Bureau asks bids until August 3 for sixteen 287,000-volt, motor-operated, disconnecting switches (Specification 1454); until August 7 for four outdoor, oil-filled 138,000-volt transformers with accessories (Specification 1561).

Paulsboro, N. J.—Sandura, Inc., Philadelphia, Pa., plans installation of motors and controls, regulators, conveyors, etc., in new six-unit linoleum manufacturing plant at Paulsboro, to replace factory destroyed by fire. Cost over $100,000.

Bremerton, Wash.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., asks bids until July 27 for 45,000 ft. light and power cable and 4,000 ft. armored telephone cable for Puget Sound Navy Yard (Schedule 2901).

Cushing, Okla.—Plans call for bids in about 30 days for equipment for new city-owned electric light and power plant, including Diesel engine-generator unit and accessories, and electrical distribution system. Fund of $350,000 secured. W. R. Holway, Tulsa, Okla., consulting engineer.

Collingswood, N. J.—Public Service Electric & Gas Company, Newark, N. J., will install underground conduit system on portion of Haddon Avenue in business district, replacing present overhead lines, including new ornamental lighting system.

Lockport, Ill.—Sanitary District of Chicago, Ill., soon takes bids for extensions and improvements in electric power plant at Lockport. Fund of $750,000 has been secured through Federal aid.

Maple Shade, N. J.—Rancocas Distilleries, Inc., care of Clifford H. Shivers, 105 South Twelfth Street, Philadelphia, Pa., architect, has plans for new multi-unit distilling plant at Maple Shade. Cost about $75,000.

Sioux City, Iowa—Has called special election July 30 to approve financing in amount of $3,612,500 for proposed city-owned electric light and power plant, including distributing lines.

Yreka, Calif.—Has authorized call for bids for new ornamental street-lighting system on Main Street.

Seattle, Wash.—City Light and Power Department soon takes bids for power plant and tailrace, high-tension switching station and other structures at Diablo, in connection with Skagit River hydro-electric power development project.

Burlington, Iowa — Burlington Brewing Company, recently organized, plans extensions and improvements in former local Moehn brewery, acquired for new plant, and will install new equipment. Cost about $60,000.

Plain City, Ohio—Asks bids until July 30 for equipment for city-owned electric light and power plant. Fund of $47,000 has been approved.

Los Angeles, Calif.—Bureau of Water Works and Supply, in co-operation with Southern Sierras Power Company, Riverside, Calif., plans early construction of 33,000-volt transmission line from Plant No. 3 of last noted company on Levining Creek to site of new tunnel construction for municipal Mono Basin water supply project, Owens River, about 21 miles. Copper cable will be used.

Denver, Colo.—K. & B. Packing & Provision Company plans installation of motors and controls, conveyors, etc., for proposed rebuilding of meat-packing plant recently destroyed by fire. Cost over $100,000.

Wheeling, W. Va.—Hazel Atlas Glass Company plans installation of motors and controls, regulators and other equipment in new addition to glass container manufacturing plant. Cost about $100,000.

Pawnee, Okla.—Soon takes bids for prime mover and auxiliaries for city-owned electric light and power plant. Fund of $60,000 has been arranged through federal aid. W. R. Holway, Tulsa, Okla., consulting engineer.

Fort Dodge, Iowa—Plymouth Corn Products Company, care of L. E. Armstrong, head, recently organized, plans new distilling plant. Cost about $65,000.

Wapakoneta, Ohio—Plans early construction of new city-owned electric light and power plant. Fund of $146,000 has been secured through federal aid.

Frankfort, Ky. — Kennebec Distillery Company plans extensions and improvements, with installation of new equipment. Cost about $125,000. Carl J. Kiefer, Cincinnati, Ohio, engineer.

Kenedy, Tex. — Has called special election on July 24, to approve financing for $161,500 for new city-owned electric light and power plant. Plans will soon be drawn.

San Mateo, Calif.—Plans extensions and improvements in fire alarm system, with installation of new equipment. Cost about $25,000.

Melrose, Minn. — Schatzbrau Brewing Company plans new power plant at local brewery, now in course of construction. Proposed to begin work in August. Entire project will cost over $200,000.

Morenci, Mich.—Has plans under way for new city-owned electric light and power plant. Cost about $125,000. Ayers, Lewis, Norris & May, Ann Arbor, Mich., consulting engineers.

MEN OF THE INDUSTRY

C. L. Harrod Resigns

Clifford L. Harrod has resigned as president of the Indianapolis Power & Light Company. HARRY T. PRITCHARD of Chicago, executive vice-president of the Utilities Power & Light Company, will become acting president of the Indianapolis company. Mr. Harrod, who has been ill some months, plans to take a short vacation and then probably will open offices in Indianapolis as a consulting experimental engineer. He has been president of the light company several years and before that was industrial commissioner of the Indianapolis Chamber of Commerce. Mr. Pritchard was a member of the board of directors of the Indianapolis company and took an active part in its management. Utilities Power & Light is a holding company, of which the Indianapolis company is a subsidiary.

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JOHN D. PRESTON has been appointed chairman of the West Virginia Public Service Commission. Mr. Preston has been a member of the commission for the past year.

EVAN O. THOMAS, for the past year general sales manager of the Electric Household Utilities Corporation, Chicago, manufacturer of Thor washers and ironers, has been elected to the additional position of vice-president. Until Mr. Thomas was called to Chicago two years ago to become assistant to E. N. Hurley, Jr., president of the company, he had been for 6½ years the Thor distributor for California, Arizona and Nevada.

HAROLD D. CONKLIN, formerly assistant general sales manager of the Edison General Electric Appliance Company, Inc., Chicago, has been appointed to the position of district manager in charge of Hotpoint range and water heater sales in California, Arizona and parts of Nevada, New Mexico and western Texas, with headquarters in Los Angeles. The San Francisco and Los Angeles districts have been merged. Mr. Conklin has been identified with the Hotpoint organization six years. Succeeding Mr. Conklin as assistant general sales manager is AUGUST JAEGER, who recently returned to the Edison Appliance company. Formerly manager of the Hotpoint appliance division, Mr. Jaeger was regional director of Electric Cookery Council just previous to his return. DAVID C. MARBLE has been appointed manager of Hotpoint's new Minneapolis sales district, which includes Wisconsin, the upper peninsula of Michigan, Minnesota, North Dakota, and portions of South Dakota and Montana. This new district was created by dividing what had been the Chicago territory into two sections. L. E. Buxton remains district manager in Chicago. Myron H. Beekman, who for several months has been acting district manager of the New York territory, has been named to the district managership permanently.

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Joseph Bowes New President of Nebraska Utility

Joseph Bowes, vice-president of the Virginia Electric & Power Company in charge of operations, has resigned his position at Richmond to become president of the Western Public Service

Company with headquarters at Scottsbluff, Neb. The Nebraska utility is controlled by the Stone & Webster interests, with which Mr. Bowes has a long record of service.

A graduate of Cornell University in electrical engineering, Mr. Bowes became associated with the Stone & Webster organization in 1909, and since that time has served in an executive capacity with a number of the Stone & Webster properties, including the Tacoma Railway & Power Company, Tacoma, Wash.; the Eastern Texas Electric Company, at Beaumont, Tex.; the Gulf states Utilities Company, Lake Charles, Iowa; the El Paso Electric Company at El Paso, Tex., and the Virginia Electric & Power Company.

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SIDNEY HOSMER, vice-president and general manager of the Edison Electric Illuminating Company of Boston, was honored by his associates July 11, the fortieth anniversary of his association with this utility. A ship's clock and barometer in bronze and a fountain pen desk set were presented to him at his offices in Boston. For many years Mr. Hosmer was superintendent of the construction bureau, attaining a vice-presidency in 1926, and becoming general manager upon the death of the late C. L. Edgar in 1932.

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CHARLES T. LAWSON, department store division manager for Frigidaire Corporation, has been named manager of a newly formed household division with supervision over all household refrigerator sales in the United States.

E. C. HAMMOND, formerly merchandise supervisor for the Atlanta division of the Georgia Power Company, has been transferred to the office of the vice-president in charge of sales. Mr. Hammond has been connected with Georgia Power for the past ten years.

T. E. HAMMETT has been appointed commercial agent of the Shawnee district of the Oklahoma Gas & Electric Company. He is succeeding Jesse Mays, resigned. Mr. Hammett was formerly connected with the Westinghouse Electric & Manufacturing Company.

S. G. CORWELL was elected a director of the Brazilian Traction, Light & Power Company at the annual meeting held recently in Toronto. He is succeeding the late R. O. Haywood.

G. E. JONES, formerly commercial representative in the Bridgeport, Conn., works of the General Electric Company in the cable division, has been transferred to the Boston office of the company as head of the wire and cable division.

WILLIAM B. HENDERSON, secretary of the code authority for machinery and allied products industry and Washington representative of the Machinery and Allied Products Institute, has been named executive vice-president of the Refrigerating Machinery Association. Mr. Henderson, who is also secretary of the Durable Goods Committee, will assume his new duties August 1 with offices in Washington.

PHILANDER BETTS, for 24 years chief engineer of the New Jersey Board of Public Utility Commissioners, has resigned from that office. After September 15 he will engage in business for himself as consultant on public utility problems incident to operation, engineering, rates and public relations, with headquarters in Newark. Before joining the New Jersey commission, Mr. Betts spent five years in Washington, D. C., as consultant engineer, principally on electric lighting and electric power distribution. He is a fellow of the American Institute of Electrical Engi-

neers and a member of the Illuminating Engineering Society and of the American Society of Mechanical Engineers.

C. N. Robinson has been appointed vice-president of the Public Service Company of Oklahoma in charge of new business. Mr. Robinson was formerly identified with the Central Illinois Public Service Company. As an electrical engineer he has been identified with the Insull group of companies for the past fourteen years.

A. D. Constable, O. B. E., has been appointed by the British Admiralty as director of electrical enginering to succeed William McClelland, C. B., O. B. E., retired. Mr. Constable entered the Admiralty service in 1903 as electrical engineer, served at the Bermuda and Gibraltar dockyards from 1904 to 1913 and was appointed to the Admiralty in 1913 under the late C. H. Wordingham. Five years later he was named assistant director of electrical engineering and confirmed as deputy in 1922. Mr. McClelland, who is retiring, was appointed to the Admiralty in 1903.

A. L. Ralston has been appointed general mechanical superintendent of the New York, New Haven & Hartford Railroad, succeeding G. A. Moriarty, who has been assigned to other duties. Mr. Ralston is well known in the electrical field, having served on the staff of the Westinghouse Electric & Manufacturing Company after graduating from Purdue University in connection with the design and construction of the first electric locomotive equipment for the New Haven road. He was located at Stamford, Conn., from 1907 to 1914 and later became assistant electrical engineer of the company with headquarters at New Haven.

OBITUARY

Annie L. Wood, for fifteen years secretary of the Engineering Societies of Boston with headquarters at the Tremont Temple library, died at Belmont, Mass., June 22, while on a three months leave of absence.

Wilbur M. Stine, physicist and an active figure in the electrical research field, died at his home in Penfield, Pa., July 4, in his seventy-first year. Dr. Stine was a pioneer in X-ray experimentation. A graduate of Dickinson College, Carlisle, Pa., he subsequently taught physics and engineering at Ohio University, in 1893 became director of electrical engineering at Armour Institute of Technology and later was appointed Williamson professor of engineering at Swarthmore College. He engaged in research work on arc and incandescent lamps, physics of fuses for electrical currents, instruments of precision for electrical measurements and in photometry and electromagnetism, as well as X-ray.

Charles P. Belden, for many years connected with the sales department of the Belden Manufacturing Company, Chicago, died July 5. Mr. Belden was graduated from Yale University in 1893 and took an active part in the affairs of the Belden company, of which his brother is president.

Edward M. Duvoisin, for ten years an electrical engineer on the staff of the General Electric Company at its Pittsfield, Mass., works, died at St. Luke's Hospital in that city July 6. He was born in Grandson, Switzerland, 40 years ago and was educated at the University of Lausanne.

Arthur F. Blair, assistant superintendent of the general service department of the Boston Edison Company since 1921, died suddenly, of a heart attack, on June 11. He was born in Roxbury, Mass., 58 years ago and entered the company's service in 1903 as a member of the laboratory staff.

D. S. Brown, executive vice-president of the Westinghouse X-Ray Company, Inc., and its active head, died suddenly July 5, after a few days' illness. Mr. Brown was chairman of the electromedical group of the X-ray and electromedical section of the National Electrical Manufacturers' Association and vice-chairman of the entire section.

NEW EQUIPMENT

Compensated Smoke Recorder

Photo-cell smoke density recorders, compensated for variations in light source intensity to give accurate records of the true relative smoke density at all times, have been announced by the Bailey Meter Company, Cleveland. The equipment consists of the receiving element and 12-in. chart recorder mounted

Bailey Meter Co.

on the boiler panel and transmitting element, consisting of transmitting and detecting cylinders on opposite sides of the breeching or flue gas passage.

The galvanometer and electronic relays of the "Galvatron" relay circuit are mounted on the back of the hinged chart panel of the recorder casing. Two photo-cells are employed as shown, connected to separate potentiometers acting in opposition, with their moving contacts tied through a galvanometer. When smoke passes through the gas passage the difference in current from the two cells causes the galvatron to adjust the contact of one potentiometer until no current passes through the galvanometer. Movement of the contact is proportional to the smoke and is geared to the recorder pen.

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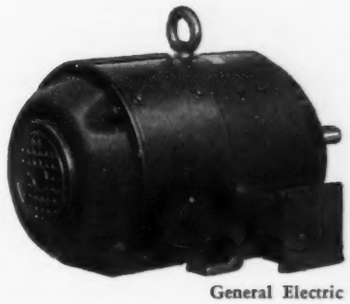
Dust-Proof D.C. Motors

Direct-current motors, designed for applications where dust, dirt, moisture or other foreign matter is present in large quantities, have been announced by the General Electric Company. The new motors are totally inclosed and fan-cooled and are available in a wide variety of electrical and mechanical modifications, in sizes from ½ to 200 hp. Dual ventilation is utilized, an internal fan drawing the warm air from the windings and core and circulating it around the totally inclosed interior of the motor so that it gives up its heat to the frame and shields. An external fan draws cool air in through mesh



General Electric

openings in an outer end shield and directs it over the surface of the magnet frame and inner end shields.

These fan-cooled motors offer, as compared with totally inclosed motors, a saving in space, greater output per pound of material, economy of opera-

tion and interchangeability with most open motors of corresponding ratings, it is claimed.

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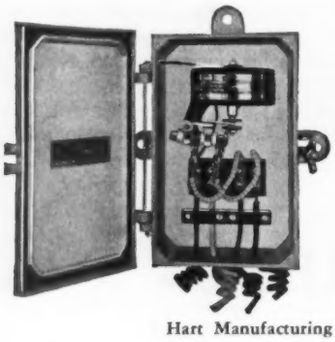
Mercury Tube Switch

A Hart mercury tube switch for the control of multiple street lighting circuits has been announced by the Hart Manufacturing Company, Hartford, Conn. A relay is incased in a weatherproof box suitable for installation in



Hart Manufacturing

the base of lighting supports or on poles. One light or group of lights may be operated by this relay. Contacts are positive. Coils are designed for continuous duty and are free from burn-outs under normal conditions. Not less than 80 volts is required to operate the relay to open circuit position.

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Pyrotip Electric Burner

A "Pyrotip" electric burner developed to provide an economical and convenient method of local heating in industrial and manufacturing operations, such as splicing cables, melting out old bearings, welding seams and lining chemical containers with lead and battery maintenance has been announced by the General Electric Company. The transformer of the Pyrotip is especially designed for portability. The casing has a handle and hooks for holding the cables when coiled. One secondary lead from the transformer is equipped with a spring clip for connecting it to the work. The other secondary lead terminates in the carbon holder.

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DESIGNED TO STAND UP under the most adverse weather conditions, the S & M Lamp Company, Los Angeles, Cal., has announced a new No. 1005 S & M "Floodlite" in 750, 1,000 and 1,500-watt ratings. Is is adapted for use on all types of construction jobs and will supersede the average heavy, cumbersome closed type floodlights now used on such jobs. It is constructed of 14-gage pure sheet aluminum, treated with the new S&M illuminous process. Electrical Testing Laboratories' tests show 87 per cent light output, with candlepower values much higher than possible to obtain from porcelain-enameled surfaces or painted surfaces.

STREET-LIGHT REFLECTORS made of "Alzak" aluminum, having high reflectivity and unusual weather-resisting properties, have been announced by the General Electric Company. Three 20-in. types are available, a dome radial-wave reflector, a flat radial-wave reflector and a dome radial-wave shading reflector. Costing but slightly more than porcelain finish for comparable reflectors, it has a reflection factor of more than 80 per cent, is rust-proof and is extremely hard and durable.

TO MEET THE NEED for high-grade semi-variable resistors of the vitreous enameled type, particularly those which could be quickly secured from an adequate stock, the Ohmite Manufacturing Company, Chicago has brought out two new lines of "Dividohm" resistors which are now carried in various values. There are two new sizes, one rated at 100 watts, which is 6½ in. long by ⅞ in. diameter, and the other rated at 200 watts, 8½ in. long and 1¼ in. in diameter.

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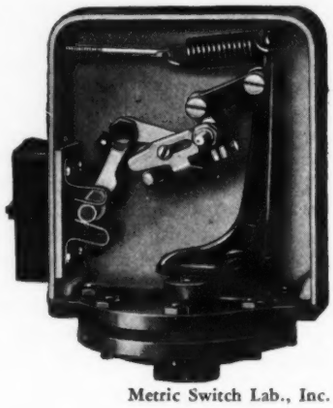
Automatic Drawout Oil Circuit Breaker

Automatic draw-out air circuit breaker in which the breaker assembly may be withdrawn from the structure for inspection and repair at greatest speed and minimum of effort has been announced by the Roller-Smith Company, New York, N. Y. Both primary and all control connections are made to the stationary part of the board by means of flexible self-aligning contacts to permit the withdrawal without disconnecting any wires. Interlocks are provided to prevent the withdrawal of the breaker when it is in the closed position.

Roller-Smith

Automatic Switches

Automatic pressure switches identified as Metric type A have been introduced by the Metric Switch Laboratories, Inc., for the control of domestic water systems, air compressors and other equipment. Housings are of gray iron with terminal connections made on the outside, solderless, and mounted on bakelite insulators in bakelite terminal housing. Phosphor bronze double-wipe type contacts are used. Counter spring



Metric Switch Lab., Inc.

adjustment on the outside of the main housing permits adjustment to a range of 25 lb. between low and high pressure. Inside adjustment of the main contact arm spring permits changing the range to any between 5 and 95 lb. pressure. A similar design type F float switch is also offered for the control of manual intermittent pumps.

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General-Purpose Electrodes for Arc-Welding Mild Steel

Heavily coated general purpose electrodes for welding with the shielded arc on mild steel and identified as "Fleetweld No. 7" have been announced by the Lincoln Electric Company, Cleveland. Pronounced welding economies are effected by the new electrode, according to the manufacturer. The new electrode is designed particularly for high-speed and single-pass welding.

Fleetweld No. 7 has a high burn-off rate and low splatter loss, providing exceptionally fast welding at low cost. The finished bead is smooth. Tests made on specimens of all-weld metal show the following characteristics: Tensile strength, 70,000 to 80,000 lb. per sq.in.; yield point, 55,000 to 60,000 lb. per sq.in.; ductility, (elongation in 2 in.), approximately 20 per cent, and resistance to corrosion, greater than that of mild steel. The new electrode is manufactured in diameters from ⅛ to ⅜ in. in 14-in. lengths and packed in 5-lb. containers. The ⅛, 5/32 and 7/64 in. sizes are designed for welding in flat, vertical or overhead positions and the larger sizes for welding in flat position only.